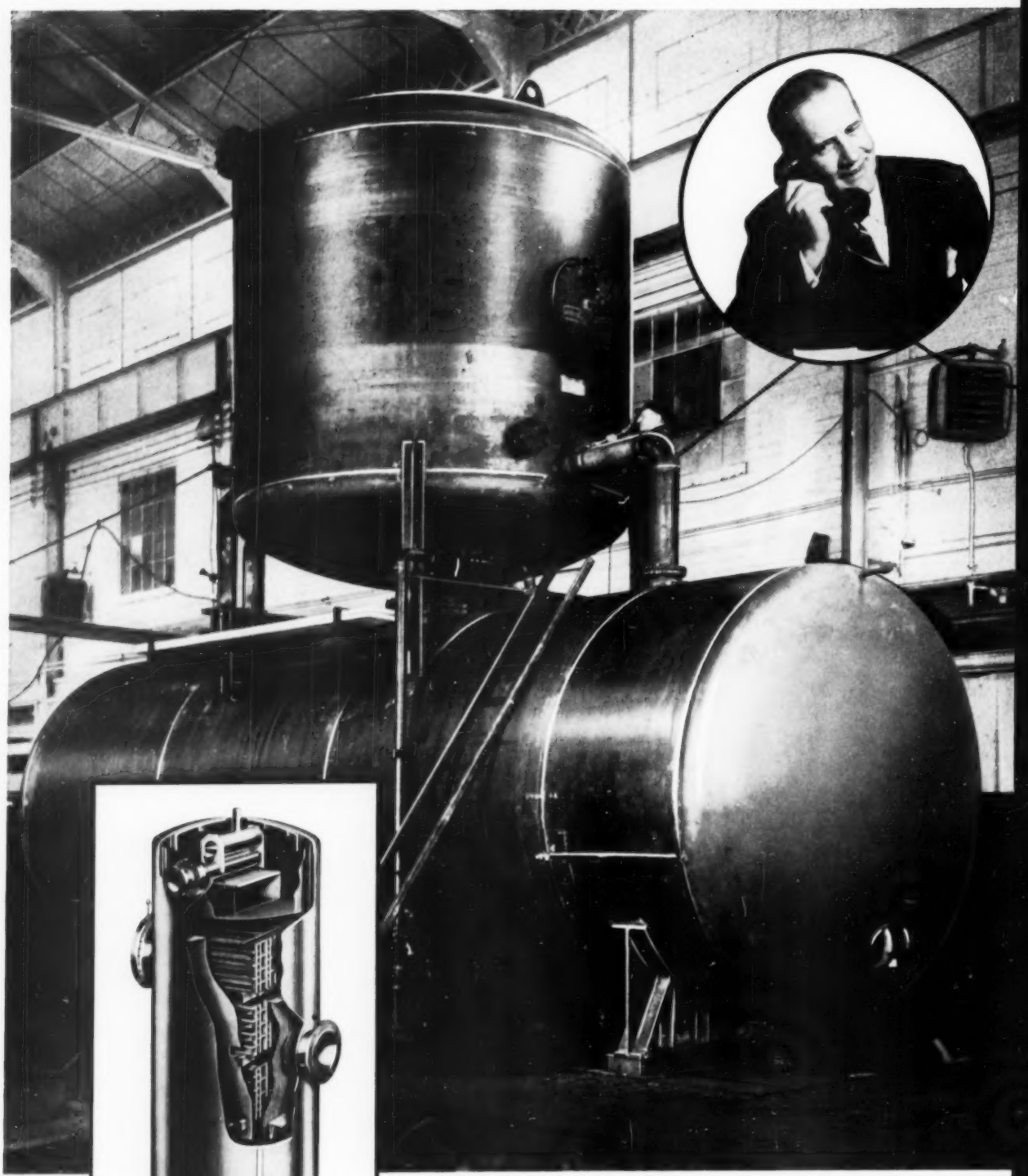
AUGUST 1954

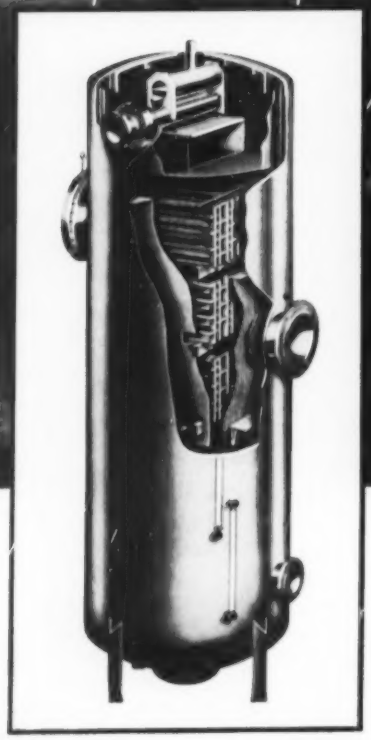
Power Engineering

Practical Radioactivity – Industrial Use of Isotopes 63
Are Your Unit Heaters Ready for Winter? 66
Winterize with Heating Cable 68
Masonry Drilling: Choosing the Right Bit, the Right Drill 70
Carbide Tries Plastic Instrument-Air Tubing 72
Multi-Purpose Lithium Grease Cuts Power Plant Maintenance 74
POWER ENGINEERING News Reel 76
Figuring Air and Water Horsepower 78
It's the Man Behind the Camera that Counts 81
More on Power Plant Noise Reduction 82
Winterizing Milaca's Diesel Plant 84
Can We Afford to De-Salt Sea Water? 86
Bad Commutation . . . Causes and Cures 88
Annual Shutdown – Time for Repairs 91
Working Is Easy at New Service Center 92
New Film Teaches Safe Welding 94
400-Cycle Fluorescent Lighting . . . More Light for Less Money 94

REGULAR DEPARTMENTS

Engineers' Preview 3
Editorial and Business Staff 3
Here's What They Tell Us 6
Helpful Bulletins 23
Equipment News 60
Construction News 46
Practical Engineer and Electrician 95
Readers' Service Post Cards 113
Advertisers' Index 128
Circulation of this Issue 34, 125





A 1,000,000-lb-per-hr deaerating feedwater heater mounted on its storage tank, just after passing its hydrostatic test in the Elliott shops. This is one of six similar units for an important utility.

◀ The latest design Elliott tray-type deaerating heater. This one is the multiple tray compartment type, designed to deliver water with commercial zero oxygen content.

N4-1

Back of ELLIOTT Deaerating Heaters

ON-THE-SPOT FIELD SERVICE

In discussing deaeration problems with your Elliott sales engineer, you are getting the cooperation of an expert, factory-trained from the ground up in every aspect of deaeration, familiar with its principles as established step by step from Elliott's first pioneering unit of a generation ago, to the present space-saving, easily serviced design.

But that isn't all —

Spotted in strategically selected centers all over the country, are a corps of Elliott field service men, thoroughly capable in the diagnosing of operating difficulties and in their correction.

Beyond this, trained personnel in the home shops in Jeannette, Pennsylvania, stand ready when needed to travel to a trouble-spot as fast as the swiftest airplane can get them there.

So — when it's a deaeration problem, either a projected installation or the servicing of one already operating, pick up the phone and call your Elliott sales engineer. Or if more convenient write or wire Elliott Company, Deaerator and Heater Department, Jeannette, Pa.

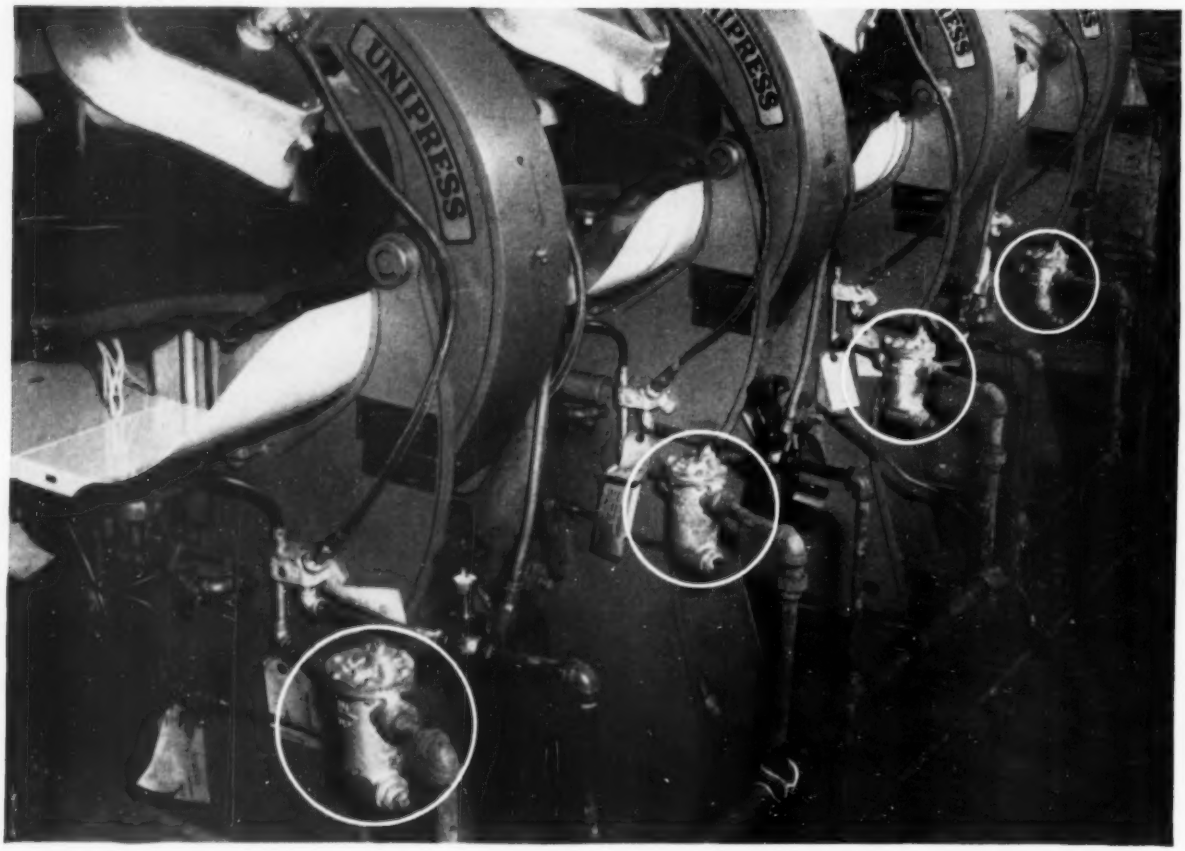
ATLANTA
BOSTON
BUFFALO
CHARLOTTE, N.C.
CHICAGO
CINCINNATI
CLEVELAND
CORPUS CHRISTI
DALLAS
DENVER
DETROIT
DULUTH
HOUSTON
INDIANAPOLIS
KANSAS CITY
LOS ANGELES
MILWAUKEE
MINNEAPOLIS
NEWARK
NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH
PORTLAND, ORE.
ROCKFORD, ILL.
SAN FRANCISCO
ST. LOUIS
SEATTLE
SYRACUSE
TULSA
WASHINGTON, D.C.
WILMINGTON

ELLIOTT Company

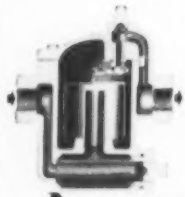
TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

For more data circle 501 on Post Card

You can't save money by skimping on Steam Traps—
An Armstrong Trap *on every unit* always pays dividends



Plant doubles production without appreciable increase in fuel costs



STRAINER BUILT IN

Built-in Strainer Traps save fittings, labor, maintenance. Cost less than separate trap and strainer. Complete data in literature mentioned below.

When Standard Coat, Apron & Linen Service took over a previous linen service plant in Portland, Maine, the boilers could hardly handle the steam load. Mr. Tom Foley, General Mgr. called Files Steam Specialty Company, Armstrong Trap Representative in New England, to help correct the condition.

Under supervision of Mr. Ken Raymond, Chief Engineer, Armstrong traps were installed on *each* unit in the plant.

Results: doubled production with no appreciable increase in fuel consumption; higher machine temperatures; boilers easily handle the load.

This is a typical example of the efficiencies and economies possible through Armstrong unit trapping. Could your plant stand a shot in the arm? Call your Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan

SEND FOR FREE CATALOG

—The "Steam Trap Book" contains 44 pages of trap data—selection, maintenance, trouble-shooting. Free on request. Or Consult Sweets or CEC.

ARMSTRONG STEAM TRAPS

For more data circle 502 on Post Card

ENGINEERS' PREVIEW

● HISTORY-MAKING cargo left Port Esquivel, Kingston, Jamaica on May 5 when the *S.S. Sun Karen*, carrying 11,000 tons of alumina refined from local bauxite, sailed on its long journey through the Panama Canal to Kitimat on the west coast of Canada, there to be smelted into aluminum. (After reading the June issue, POWER ENGINEERING, page 84, you know all about Kitimat).

This first shipment of alumina to Kitimat establishes the supply line for what may become the largest integrated aluminum operation in the world.

First stage of the hydroelectric power and aluminum complex in British Columbia, more than three years in construction, goes into operation this summer.

Production of alumina in Jamaica has been under way since early last year by Alumina Jamaica Limited, subsidiary of Aluminum Limited, Montreal. Its plant is being expanded to supply the 20 or more boatloads of alumina per year required to supply Kitimat and other users.

• • •

● SOARING 615 ft above a base 22 ft high, the chimney for the iron ore plant of The International Nickel Co. of Canada, Ltd. at Copper Cliff, will take the title of "tallest in the British Commonwealth," which for many years has been held jointly by the two 500-ft stacks at Inco's Copper Cliff smelter. The great height of the chimney at the new plant is to ensure proper diffusion of waste gases in the upper atmosphere. The new plant will make metallurgical history by recovering high-grade by-product iron ore from nickel ores mined in the Sudbury District.

● ATOMIC ENERGY Commission has entered an agreement with five utility companies of the Pacific Northwest under which the companies will study the feasibility of designing and constructing a nuclear reactor for the production of electric power. This study is the first to be undertaken by concerns in the northwest where there is a growing demand for new sources of power. This project brings to 13 the nuclear power studies being made under the Commission's Industrial Participation Program. Utility companies taking part in this project are Montana Power Co., Butte, Mont.; Washington Water Power Co., Spokane, Wash.; Pacific Power and Light Co., Portland, Ore.; Portland General Electric Co., Portland, Ore.; and Mountain States Power Company, Albany, Ore.

• • •

● TELEGRAPHING spare parts all over the world — that's the interesting possibility engineers see for tape-controlled automatic machine tools.

Employing the principle of the player-piano roll — holes punched on a tape — lathes and other machine tools can be made to follow a pattern to reproduce parts automatically and in great quantities. If the pattern information can be put on teletype tape, it can be telegraphed to distant places to control machine tools on the spot.

The tape control principle and other mechanical and electronic duplicating devices are discussed by Frederick W. Cunningham, Arma Corp., Garden City, N. Y., in an article in the June issue of *Mechanical Engineering*.

• • •

● THE Catholic University of America, at its June commencement exercises in Washington, D. C., conferred on William F. Ryan, of Boston, the honorary degree of Doctor of Science in recognition of his "distinguished services in the field of engineering, with particular reference to the spiritual and moral aspects of the profession."

Dr. Ryan is vice president and senior consulting engineer of Stone & Webster Engineering Corp., Boston. An engineer of international repute in the electric power field, he holds degrees of A.B. and M.M.E. from

EDITORIAL AND BUSINESS STAFF

POWER ENGINEERING IS PUBLISHED MONTHLY • 110 S. DEARBORN ST., CHICAGO 3, ILL. DEARBORN 2-5446

EDITORIAL AND ART STAFF

Editorial Director — Richard H. Morris
Editor — Andrew W. Kramer
Executive Editor — Chester R. Earle
Associate Editor — Norman S. Jones
Associate Editor — Robert J. Mitchell
Associate Editor — R. C. Hagenmiller
Equipment Editor — Marian E. Heniken
Assistant Editor — Irene M. Glen
Staff Artist — James E. Wilcox
Chief Draftsman — Robert W. Koster

OFFICERS AND BUSINESS STAFF

President — Kingsley L. Rice
Executive Vice President — Edwin C. Prouty
Vice President — Walter Painter
Vice President in Charge of Sales — Richard M. Ward
Treasurer — Arthur L. Rice, Jr.
Assistant Treasurer — Thomas Walsh
Secretary — Edwin C. Prouty, Jr.
Production Director — John O. Aarvold
Production Manager — Earl R. Noren

Technical Publishing Company is incorporated under the laws of the State of Illinois. Board of Directors: Kingsley L. Rice; Arthur L. Rice, Jr.; Andrew W. Kramer; Edwin C. Prouty; Richard H. Morris.

ADVERTISING SALES STAFF

Vice President in Charge of Sales — Richard M. Ward

DISTRICT MANAGERS

Boston 16, Mass. 258 Park Square Bldg. — Edmund J. Shea, HAncock 6-4639
New York 17, N. Y. 1613 Graybar Bldg. — Richard Y. Fuller, MUrray Hill 5-3779
Philadelphia, Pa. 1235 Jericho Road (Abington, Pa.) — Oscar Wilds, Ogontz 6843-W
Pittsburgh 19, Pa. 404 Frick Bldg. — James B. Tafel, COurt 1-4878
Cleveland Heights, O. 2945 Fairmount Blvd. — Richard M. Ward; F. Allen Schmidt, FAirmount 1-0616
Chicago 3, Ill. 110 S. Dearborn St. — Walter Painter; Warren F. Saas, DEarborn 2-5446
Detroit 1, Mich. 2230 Park Ave., Room 7 — Richard M. Ward, WOodward 5-2268

McDonald-Thompson offices: Seattle 4, Wash., Harry Abney, 1008 Western Ave., Elliott 3767; San Francisco 5, Cal., Les Meek, 615 Market St., YUkon 6-0647; Los Angeles 5, Cal., Connie J. Grabb, 3727 West Sixth Street, DUnkirk 7-5391; Denver 2, Colo., Robert Heidersbach, 222 Colorado National Bank Building, Keystone 4-4669; Houston 6, Texas, Frank Vickery, Room 214, 3214 Montrose Blvd., LYnchburg 6711.

Subscription information: Published monthly; price in the United States and its possessions $10, in Canada $11, in other countries $12 per year; single copies $1.00.

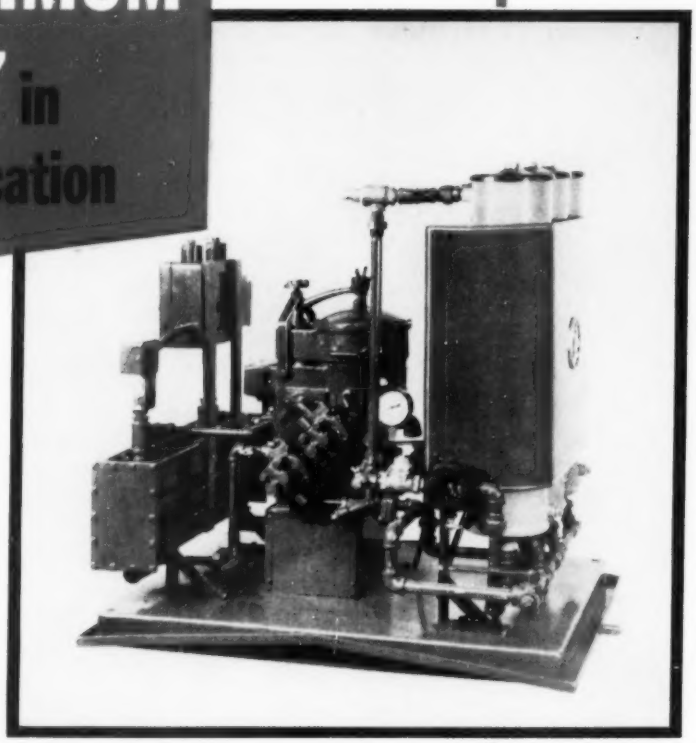
Micro film edition $4.75 annually from University Microfilms, Inc. Ann Arbor, Mich. All volumes since 1948.

Indexed in the Industrial Arts Index and the Engineering Index on file in public and many private libraries.

Copyright 1954 by Technical Publishing Co. Acceptance under Section 34.64 P. L. & R., authorized publication office at Concord, N. H.

PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

"DE LAVAL" MEANS "MAXIMUM PROTECTION" in Diesel Lube Purification



When De Laval "Puri-Filters" stand guard over your Diesels you can be absolutely sure that you are meeting these two basic requirements!

(1) *Thoroughly* removing both solid and liquid contaminants: dirt, water and colloidal carbon . . .

(2) Doing so *continuously*—with 24-hour per day dependability, day after day, month after month, even year after year.

The record of De Laval "Puri-Filters" is outstanding. That is why you will see De Laval "Puri-Filters" on guard in so many of the most efficient Diesel-equipped plants and aboard so many Diesel-powered vessels.

Complete protection plus *continuous* protection is *maximum* protection—DE LAVAL PROTECTION—the only kind you should have for your Diesels.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York ● 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5

DE LAVAL

LUBRICATING OIL FILTERS

For more data circle 503 on Post Card

Harvard University. Dr. Ryan is an honorary member of ASME, and a past president of the Massachusetts Society of Professional Engineers. He is also active in the affairs of other technical societies and was, for several years, chairman of the Ethics Committee of the Engineers Council for Professional Development. He is author of numerous technical articles and recently received The New England Award in recognition of his engineering achievements.

• • •

WITH SCORES of outstanding achievements in its area, the Philadelphia Section of ASCE, selecting the Seven Engineering Wonders of Delaware Valley, U. S. A., has named the Fairless Works of the United States Steel Co., at Morrisville, Pa., as the major engineering project in the area.

• • •

ONE MORNING last fall, Dr. Everett P. Partridge of Hall Laboratories, was busy at his desk when one of his associates entered his office grinning from ear to ear and carrying a copy of the Oct. 1953 issue of POWER ENGINEERING. It was open to page 95.

"Look at this," he said, and when he read it, Dr. Partridge grinned too. It was the Ten Commandments for Engineers. Dr. Partridge and his

The
Ten Commandments

FOR TECHNICAL MEN

associates thought it was so good they have had reprints made of the item, in large type on 9- by 12-inch heavy board, suitable for framing or tacking on the wall, as shown in the illustration.

If you want one of these reprints, write to Dr. Everett P. Partridge, Director, Hall Laboratories, Inc., Hagan Bldg., 323 Fourth Ave., Pittsburgh, Pa.

Incidentally, neither Robert H. Emerick, who found the commandments and sent them to us, nor we, have found the author. But an engineer wise and witty enough to write those commandments, is more interested in their wisdom than in gaining notoriety. If he ever claims authorship, we'll let you know.

• • •

INTERESTING compilation of data on lead and lead products has been published in an attractive 48-page brochure by a company that refines more lead than any other organization in the world. The company has grouped in this brochure, for easy reference, many of the known data on lead, its alloys and their uses; also included are brief descriptions of the various lead products that the company sells to the process industries.

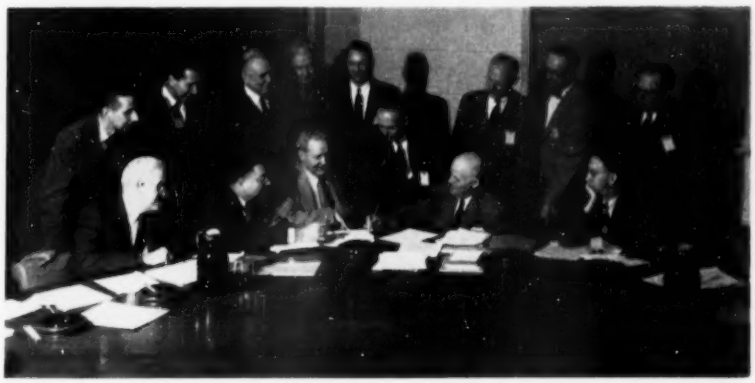
Twenty-three pages are devoted to text, with an additional 20 pages given to reference notes and conversion tables. Text chapters cover: 1, lead as a construction material; 2, grades of lead; 3, sheet lead; 4, lead pipe; 5, lead fittings; 6, solid lead valves and lead-lined valves; 7, lead burning and construction, also some recommended methods of sheet lead-lined construction; 8, pig, ingot, and wool for caulking; 9, lead specialties.

Copies of the brochure are available to engineers concerned with the handling of lead. Address your request, written on company letterhead, to The Editor, POWER ENGINEERING.

Atomic Energy—Advisory Committee in Action

YOU HAVE seen many references in POWER ENGINEERING to the activities of our editor, Andrew W. Kramer, in the field of atomic energy (properly called nuclear energy). Mr. Kramer was one of the first to interpret atomic energy developments to engineers. At the time of the first announcement of the Hiroshima bomb, he ran a series of fine articles on the subject in POWER ENGINEERING, and today as an extra activity, he is editing our companion magazine, *Atomics*. Mr. Kramer has been addressing engineering groups all over the country on atomics for several years.

As recognition of his standing, two years ago Mr. Kramer was appointed to the Advisory Committee on Industrial Information of the Atomic Energy Commission. We thought you might like to see that committee in action. Andy, who is standing in the center, seems to be injecting a lot of humor into the proceedings.



Front row (seated) L to R: Dr. Elmer Hutchisson, American Institute of Physics; S. A. Tucker, American Society of Mechanical Engineers; E. E. Thum, American Society for Metals; S. D. Kirkpatrick, Chairman, McGraw-Hill Publishing Co.; Keith Henney, American Institute of Radio Engineers, at a recent committee meeting

Back row (standing) L to R: N. H. Jacobson, Assistant Secretary, Chief, Industrial Information Branch, U. S. Atomic Energy Commission; Dr. Alberto Thompson, Secretary, Chief, Technical Information Service U. S. Atomic Energy Commission; Walter E. Jessup, American Society of Civil Engineers; Frederick Pawley, American Institute of Architects; Dr. Allan G. Gray, Penton Publications; Andrew W. Kramer, POWER ENGINEERING; Edward H. Robie, American Institute of Mining & Metallurgical Engineers; Karl T. Schwartzwalder, American Ceramic Society; Walter J. Murphy, American Chemical Society, are the other committee members

HERE'S WHAT THEY TELL US

J. E. Donnelly, maintenance engineer, U. S. Steel Corp., wrote:

> In your issue of March, 1953, there was an article on page 75 under Practical Hints and Kinks, titled Percussion Lance Speeds Tube Cleaning. I should appreciate knowing where I can secure more information on the lance, and the name of the nearest distributor or manufacturer.

The lance was originally developed by Airnesco Products, Inc., in England, and was first called to our attention by an engineer in the British Electricity Authority who had used it very successfully. By use of a special mechanism, with normal 100 psi air supply, the lance produces a percussion effect of 1600 psi for tough cleaning jobs.

We had many inquiries about it and Airnesco sold many of the lances in this country — so many, in fact, that Airnesco Products now has American representation. And by a good stroke of luck, the company's representative was in the state of Pennsylvania at the time we received Mr. Donnelly's letter.

L. René Duval, who is with Fabrica Dominicana De Cemento in Ciudad Trujillo, Dominican Republic, informed us:

> Almost every month I get something valuable from your magazine. I have just made a chlorine cylinder lifter from the design of H. T. Livingston, in the January 1954 issue — we have to lift our one-ton cylinders off a barge to place them on the deck with the circulating water pumps.

"... Great pair!"

M. T. Anderson, maintenance engineer, Illinois Tool Works, was another one of many who wrote for complete details on the lifter. So far, no one has had any serious trouble building it.

Rev. Joseph F. Oberle, assistant rector, St. Mary's College, apparently has been doing a good bit of general research on his own. In a very honest appraisal of his problems he told us:

> I discovered your magazine just about six or seven months ago, when I came here to supervise maintenance, buying, etc. I have been going through it faithfully before passing it on to my boiler-room crew.
>
> Our boiler room definitely needs rejuvenating: the heat is inadequate, and/or distribution faulty; the boilers are allowed to operate at less than three-fourths their original capacity.
>
> Have you ever printed any articles on the relative merits, costs, etc., of coal, oil or gas? Do you know of any engineers who could study our situation without determining in advance that we must buy certain makes of equipment?

We forwarded considerable data, including names of several consultants who have done much good work in designing small boiler plants. We pointed to the article on Fuel Cost Comparisons that appeared in our January issue, and recommended the new bulletin available from the Fairmont Coal Bureau. If you haven't seen it, and want costs for a coal-burning plant, their new *No. 16* describes a typical steam-plant design for 35,000 lb-per-hr units. We hope it helped Rev. Oberle.

Most rewarding comment from **A. John,** assistant general manager of Thomas C. Wilson, Inc., said:

> We note a recent article entitled How to Use Your Boiler Tube Cleaners Properly, in the May issue of POWER ENGINEERING. We wish to express our appreciation for covering such a field in so few words.

Addressed to **Chester Earle,** a friendly note from **John Drabelle** made us green with envy when we read:

> I deeply regret that neither you nor **DICK MORRIS** can come down to Conch Land here at Key West, and meet my good Conch and Spanish friends who have been so kind and helpful to me. I know you would at least have a change of scenery and a good time.
>
> We have just had a red-hot election here, the Conches versus The Miami Herald, and it made one think of the days in Chicago when "Bath House John and Hinky Dink" held forth in Ward One.

It must be indexing time in many places. **Molly Kingsley,** Board of Water & Electric Light Commissioner, Lansing, Mich., wrote:

> We are having our 1953 copies bound and it is necessary that we have the index for POWER ENGINEERING.

A. Diatloff, Bulimba Power House "A", Southern Electric, Queensland, Australia, requested annual indexes of POWER ENGINEERING for the years 1953, '52, '51 and '50.

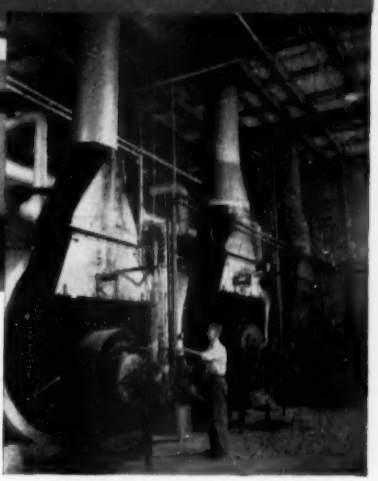
"Police raided us yesterday ... thought they were slot machines."

Dana B. Lockart, chairman of the National Association of Power Engineers, Inc., New York State Association, sent in this very personal request to POWER ENGINEERING Editor **Andrew Kramer:**

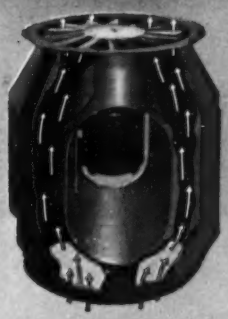
> The Albany Chapter of the National Association of Power Engineers, Inc., is sponsoring the New York State Association Convention this year and the Committee in charge of the program arrangements wish to present an outstanding speaker to the assembled delegates and guests for the Educational Session.
>
> Several committee members, including the writer, have read your article, Here and There with the Editor, in the March issue of POWER ENGINEERING and we are agreed that we would like you to be our guest speaker for this occasion on June 11.

Editor Andrew Kramer was pleased with this opportunity to address the power engineers in Albany, N. Y. He talked about atomic power.

CONSTANT BOILER DRAFT
at 1/3 the cost of a brick stack



ABOVE: Mounted on the roof at Viroqua Co-op Creamery, Viroqua, Wisconsin, are two 2-stage Induced Draft Bifurcators, each with 27" fan wheel and 3 HP open drip-proof motor, and one 2-stage Induced Draft Bifurcator with 24" fan wheel and 2 HP open drip-proof motor. All have motor chamber weather louvers.



HOW BIFURCATOR FAN WORKS

The Induced Draft Bifurcator is a direct motor driven fan in a divided housing. The motor is in an isolated chamber around which the flue gases are by-passed. Thus the motor always remains cool, clean and easily accessible. Induced Draft Bifurcators are available with fan wheels from 12" through 36" in diameter, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers delivering up to 190,000 EDR.

If you have a difficult stack problem, read what Sylvan Dregne, manager of the Viroqua Co-op Creamery, says:

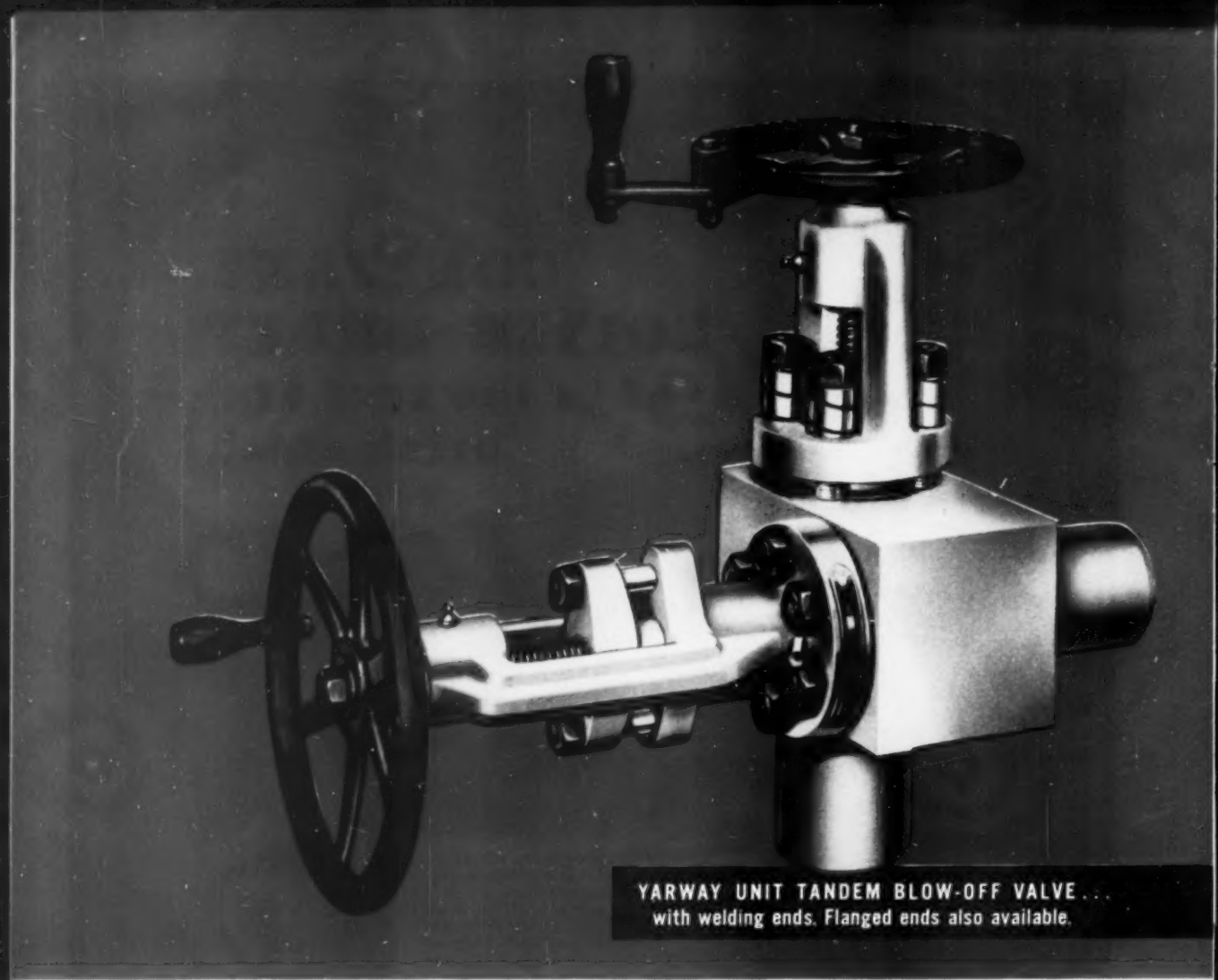
"We have two 200 and one 125 HP oil-fired boilers. During our busy season, we use two boilers for about 15 hours a day, 7 days a week and the one boiler for about 5 hours more after the peak load is over. We installed the Bifurcator Fans in September, 1951, and we have used them since then without any service required. They have proved to be very satisfactory, and they maintain a constant draft regardless of weather conditions. We installed these fans for approximately 1/3 the cost of a suitable brick stack."

How much can YOU save by installing Induced Draft Bifurcator Fans? Ask your DeBothezat representative or write our factory for details. Address Dept. PO-854.

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

For more data circle 504 on Post Card



YARWAY UNIT TANDEM BLOW-OFF VALVE . . .
with welding ends. Flanged ends also available.

BUILT TO "TAKE IT" AT

HIGH PRESSURES

● As boiler pressures go up . . . so does the demand for Yarway Unit Tandem Blow-Off Valves. *Why do more than 4 out of 5 high-pressure boiler plants now use Yarway Blow-Off Valves?*

Yarway Unit Tandems are designed for strength, built to safeguard lives and investments, and to withstand severest acid-wash service.

A rugged, compact one-piece forged steel block serves as the space-saving common body for both valves, eliminating intermediate connections. Stelliting on seats and discs in the hard-seat valves provides longer life and better service. Balanced sliding plungers do the same on the seatless-type valves. Other design and metallurgy features add a high safety factor.

A FEW TYPICAL USERS

UTILITIES

Philadelphia Electric Company
Pacific Gas and Electric Company
Dallas Power and Light Company
Boston Edison Company
Cleveland Electric Illum. Co.

HARD-SEAT (Blowing) VALVE

Stellited and ground disc and seat.

Cast Steel Yoke.

Stainless steel stem.

Alemite lubrication (fitting on yoke hub) of stem and bushing threads.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Inlet and outlet nozzles welded into body. Flanged or welding ends provided.

SEATLESS (Sealing) VALVE

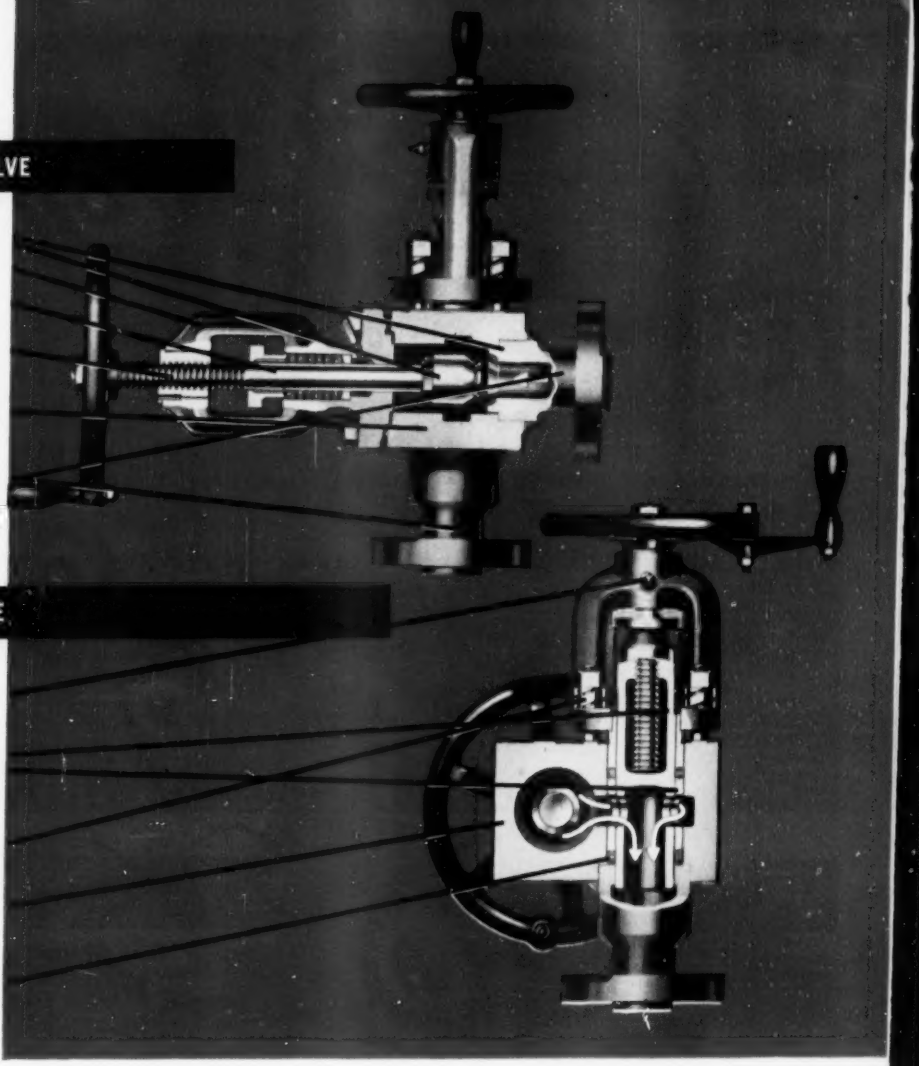
Alemite lubrication of plunger and ball thrust bearing in yoke.

Nitralloy plunger and lower follower gland. Stainless steel plunger and Ni-Resist gland available for acid wash service.

Yoke springs maintain required pressure on packing at all times.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Laminated lower packing ring with stainless steel reinforcing inserts.



Unit Tandems are available in the hard seat—seatless valve combination for pressures to 1500 psi, or in the hard seat—hard seat combination for pressures to 2500 psi. Both provide positive opening and closing with drop-tight shut-off.

Write for Yarway Bulletin B-434.

YARNALL-WARING COMPANY

114 Mermaid Avenue, Philadelphia 18, Penna.

BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY® blow-off valves

INDUSTRIAL PLANTS

Toledo Edison Company
Georgia Power Company
Union Electric Co. of Missouri
Rochester Gas and Electric Co.
Indianapolis Power and Light Co.

Bethlehem Steel Company
Ford Motor Company
Weyerhaeuser Timber Co.
Anheuser Busch Company
Procter & Gamble Company

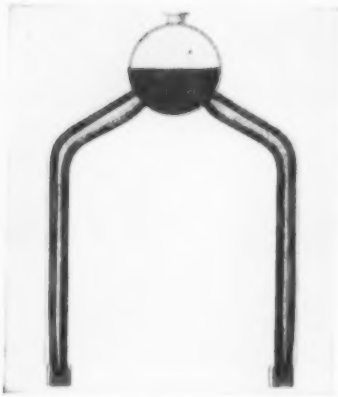
Southern Kraft Corporation
Chrysler Corporation
Container Corp. of America
Eastman Kodak Company
American Viscose Company

AN *Exclusive* ERIE CITY DESIGN

The **VL** with EXCLUSIVE features guarantees a minimum of furnace maintenance and insures a positive supply of clean water to the water walls. These EXCLUSIVE features are the result of many years of experience in building two drum boilers; thousands of which are operating in the field today, giving users the satisfactory service they demand.

We Pay Royalties to No One for These Designs

COMPARE THESE *Exclusive* FEATURES

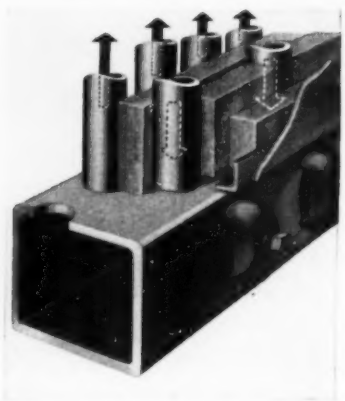


RING-FLOW CIRCULATION IN EACH WATER WALL ELEMENT

For each pair of inside steam tubes, there is a water circulating tube which feeds **clean** water from the top drum to bottom water wall headers. Dividing insulation keeps water circulating tubes cool while heat is carried away from refractory by the steam generating tubes, assuring ring-flow circulation in each element.

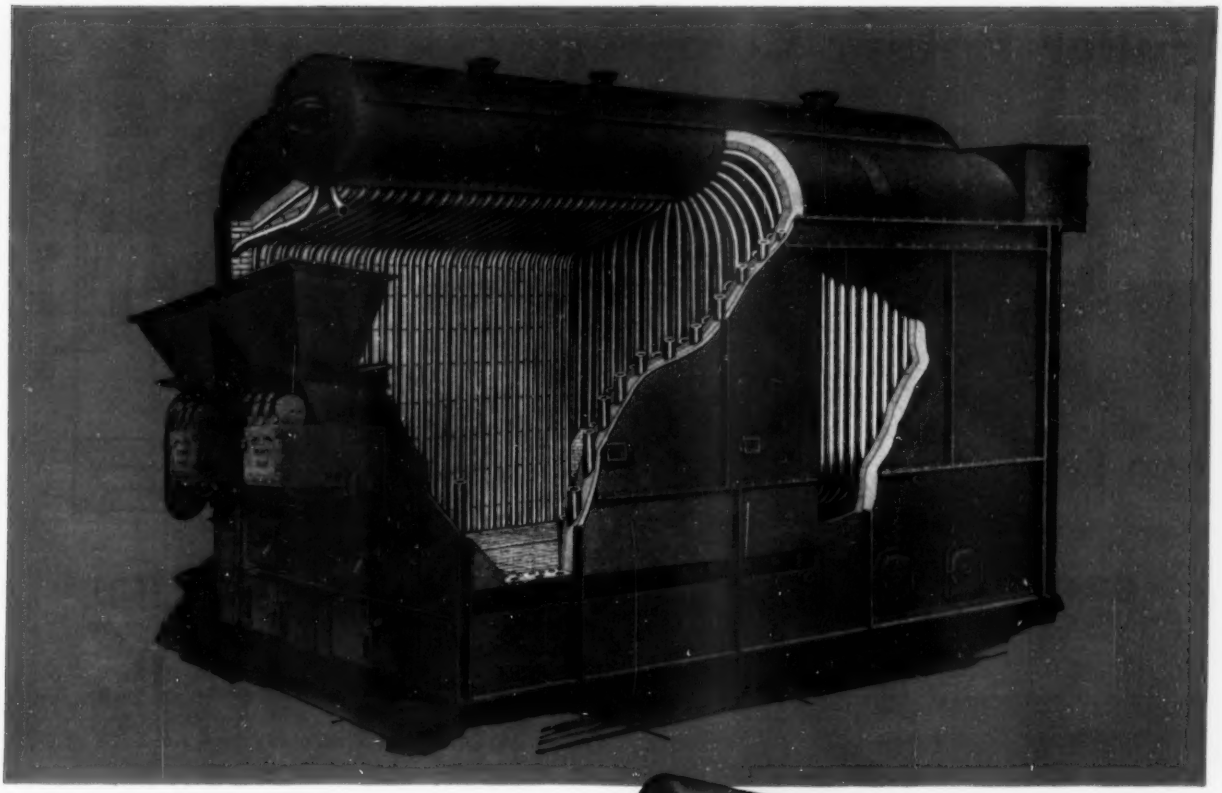
POSITIVE WATER SUPPLY TO WATER WALLS

Normal water level is at the middle of the top drum, but to **assure positive water supply** to bottom headers, under any abnormal conditions, we locate a pair of front feeder tubes at lowest point in the top drum.

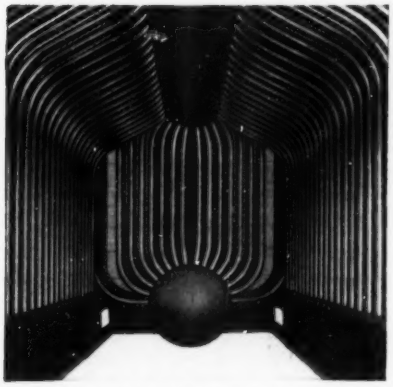


WATER WALLS ACCESSIBLE FROM OUTSIDE THE SETTING

No need to go into the furnace to inspect the water wall headers —VL's are equipped with large handhole openings, **located outside the setting,** for access to any part of the header. No elaborate tools required to remove handhole plates. View above also shows how each downcomer tube supplies a pair of steam or riser tubes in side water wall element.

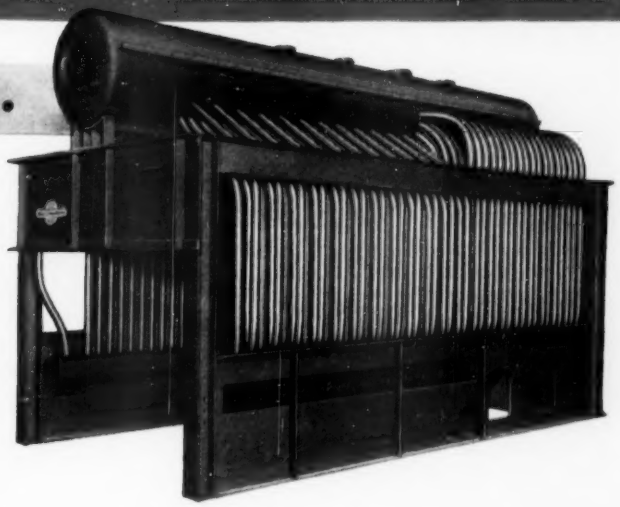


WITH THE FIELD....



LOW FURNACE ROOF PROTECTS BOILER TUBES

Furnace tubes entering low on the drum **protect drum shell** and top ends of boiler tubes from radiant heat absorption in the event of water low in the gauge.



The VL's integral water wall design with large water and steam capacity combine to make this steam generator universally accepted for its good performance, low maintenance, and ready adaptability to any firing method. Catalog SB-43 gives a detailed description and dimensional data on the Erie City VL Steam Generator.

ERIE CITY
114 Years in Steam Generation

You can depend on Erie City for sound engineering

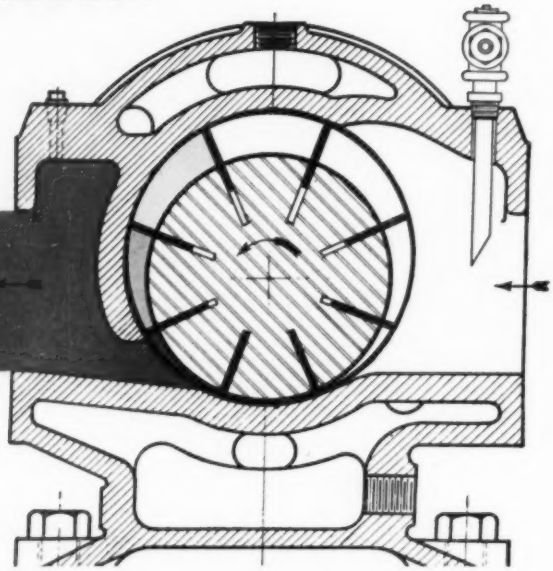
ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS

UNDERFEED AND SPREADER STOKERS • PULVERIZERS

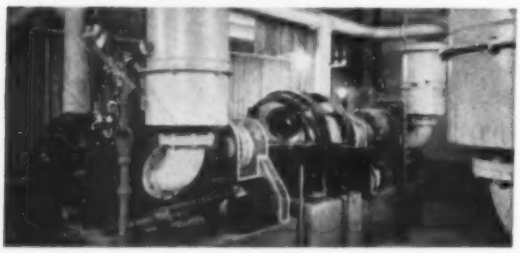
For more data circle 506 on Post Card

Fuller Rotary Compressors put the EQUIPMENT on compression costs



...for pressures up to 125 lb.

Three Fuller Rotary Single-stage Compressors. Capacity each 1400 c.f.m., 19-lb. pressure.



Fuller Rotary Single-stage Duplex Compressor. Capacity 2010 c.f.m., 35-lb. pressure.

Fuller Rotary Two-stage Compressor. Capacity 1665 c.f.m., 100-lb. pressure.

When you consider all the many uses you have for compressed air, you should give careful thought to the best way to get compression with dependability, plus minimum cost and attention—selection of the proper compressor at the required pressures to do the work in the most efficient manner. Fuller builds the compressor that has *earned* a reputation for dependability and long life—for pressures up to 125 psig.

Fuller Rotaries have so many inherent advantages that they warrant your closest examination. Free from reciprocating parts, with no valves to leak or seats to grind, no unbalanced forces to set up vibration, they assure low-cost, smooth-flow operation during their long life. And, they give you *original, maintained capacity*.

Check your compressed-air needs . . . a Fuller engineer, specializing in compressed-air engineering, will give you the *right* recommendation to enable you to produce air efficiently, and at the lowest possible cost. Write now.

FULLER COMPANY, Catasauqua, Pa.

Branch Offices

Chicago • San Francisco • Los Angeles • Seattle • Birmingham

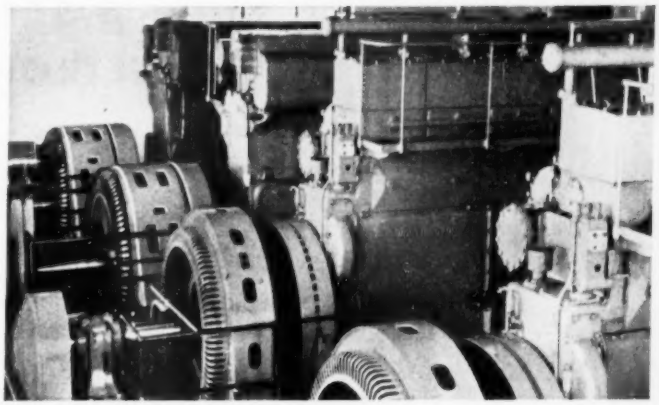
Fuller

C-237
2157

Pioneers of high-efficiency vane-type rotary compressors

For more data circle 507 on Post Card

"12,000 H.P. Hours per Gallon with Sinclair RUBILENE"



... says Leo D. Bradley, Manager
Western Michigan Electric Co-operative, Scottville, Michigan

"Our two Cooper Bessemer super-charged 1600 H.P. Model LS8T diesels deliver over 12,000 H.P. Hours per gallon of Sinclair RUBILENE H.D. Oil consumed," says Leo D. Bradley.

"We give much of the credit to the quality of this oil," continues Mr. Bradley. "RUBILENE® keeps our diesels exceptionally clean. Wear is kept at a minimum – the result is high efficiency ... low operating costs ... and low maintenance cost."

Sinclair Products have been used since the generating station first went into operation – 12 years ago. The recommendations made by a Sinclair Lubrication Engineer at that time plus continuous counseling service and superior Sinclair Products have meant substantial savings for this co-operative.

Perhaps a Sinclair Lubrication Engineer can help solve some of your lubrication problems. Phone your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

prolong engine life

For more data circle 508 on Post Card

Now!...

An INTERRUPTING RATING in EXCESS of 100,000 AMPERES *for every set of fuse clips in your plant* . . . simply by installing FUSETRON *dual-element* FUSES

The Biggest Electrical Protection NEWS Since BUSS invented the FUSETRON Dual-Element FUSE

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

In 1947 tests made by the Electrical Testing Laboratories of New York, showed that on a circuit set to deliver 50,000 amperes, FUSETRON fuses in all tests cleared the circuit safely.

50,000 amp. Interrupting Capacity in 1947
becomes
100,000 amp. Interrupting Capacity Today

After years of intensive development work on FUSETRON fuses new tests were conducted under conditions that simulated the most severe field conditions and these tests were witnessed and verified by the Electrical Testing Laboratories of New York.

On circuits set to deliver in excess of 100,000 amperes, 30 to 600 ampere, 250 and 600 volt FUSETRON dual-element Fuses on each and every test cleared the circuit without belching flame or venting hot gases and with comparatively little noise.

Oscillograms of these tests interpreted by the Electrical Testing Laboratories, showed that the total available amperes including the direct current component, reached values as great as 165,000 peak amperes on 240 volt tests and as high as 212,000 peak amperes on the 535 volt tests.

This indicates that an interrupting rating of 100,000 amperes for FUSETRON dual-element fuses is a conservative one.

No interference with time-lag

In the development work to increase interrupting capacity in FUSETRON fuses it was kept in mind that the time-current characteristic must be maintained. Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses.

Remarkable results have been achieved. Interrupting capacity has been greatly increased while the time-current characteristic of FUSETRON fuses has in no way been disturbed.

Play Safe – install Fusetron Fuses throughout the entire electrical system!

Think!...

ALL THIS ADDED SAFETY *without changing a panelboard or switch... plus* 10 Point Protection of FUSETRON *dual-element* FUSES!

Maximum Safety

With FUSETRON Fuses there is no cascading of interrupting rating — no places where an excessive fault current might cause serious damage. Every FUSETRON fuse has an interrupting rating in excess of 100,000 amperes.

You don't have to worry about selecting chosen spots in which to *pay extra* for "safe" equipment. Wherever a FUSETRON fuse is installed you have safety as sure and dependable as you can buy — no matter what you pay.

No Maintenance Costs

When FUSETRON fuses have once been installed properly you can forget about them. They need no periodic inspections to see if they will operate safely.

Dust, fumes, corrosion or age cannot prevent a FUSETRON fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

With FUSETRON fuses — you get safety — without one cent spent for inspection or maintenance costs.

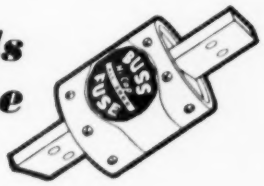
No Recalibration Costs

When a FUSETRON fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse that has been CALIBRATED AT THE FACTORY BY ENGINEERS— a fuse that is as safe and dependable as the one that blew.

PLUS 10 POINT Protection with FUSETRON dual-element FUSES

1 Protect against short-circuits. **2** Protect against needless blows caused by harmless overloads. **3** Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation. **4** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5** Protect motors against burnout from overloading. **6** Protect motors against burnout due to single phasing. **7** Give DOUBLE burnout protection to large motors — without extra cost. **8** Make protection of small motors simple and inexpensive. **9** Protect against waste of space and money — permit use of proper size switches and panels. **10** Protect coils, transformers and solenoids against burnout.

for SAFE PROTECTION on loads above 600 and up to 5000 Ampere install BUSS Hi-Cap FUSES



Tests have shown that BUSS Hi-Cap fuses have unlimited interrupting capacity on circuits of 600 volts or less.

They are designed to give protection against dangerous overloads as well as high fault currents — yet their speed of operation on heavy shorts limits currents to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

When coordinated properly with FUSETRON dual-element fuses they will not open ahead of the fuses nearest to the fault. Thus trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of a bad fault.

ACTION THAT SAVES YOU MONEY

By passing the word along that all purchase and stock records should call for FUSETRON fuses on loads up to 600 amps—and BUSS Hi-Cap fuses on loads above that — you get action that begets money saving.

For blowing time charts or more information on FUSETRON Fuses and BUSS Hi-Cap Fuses write for Bulletins FIS and HCS.

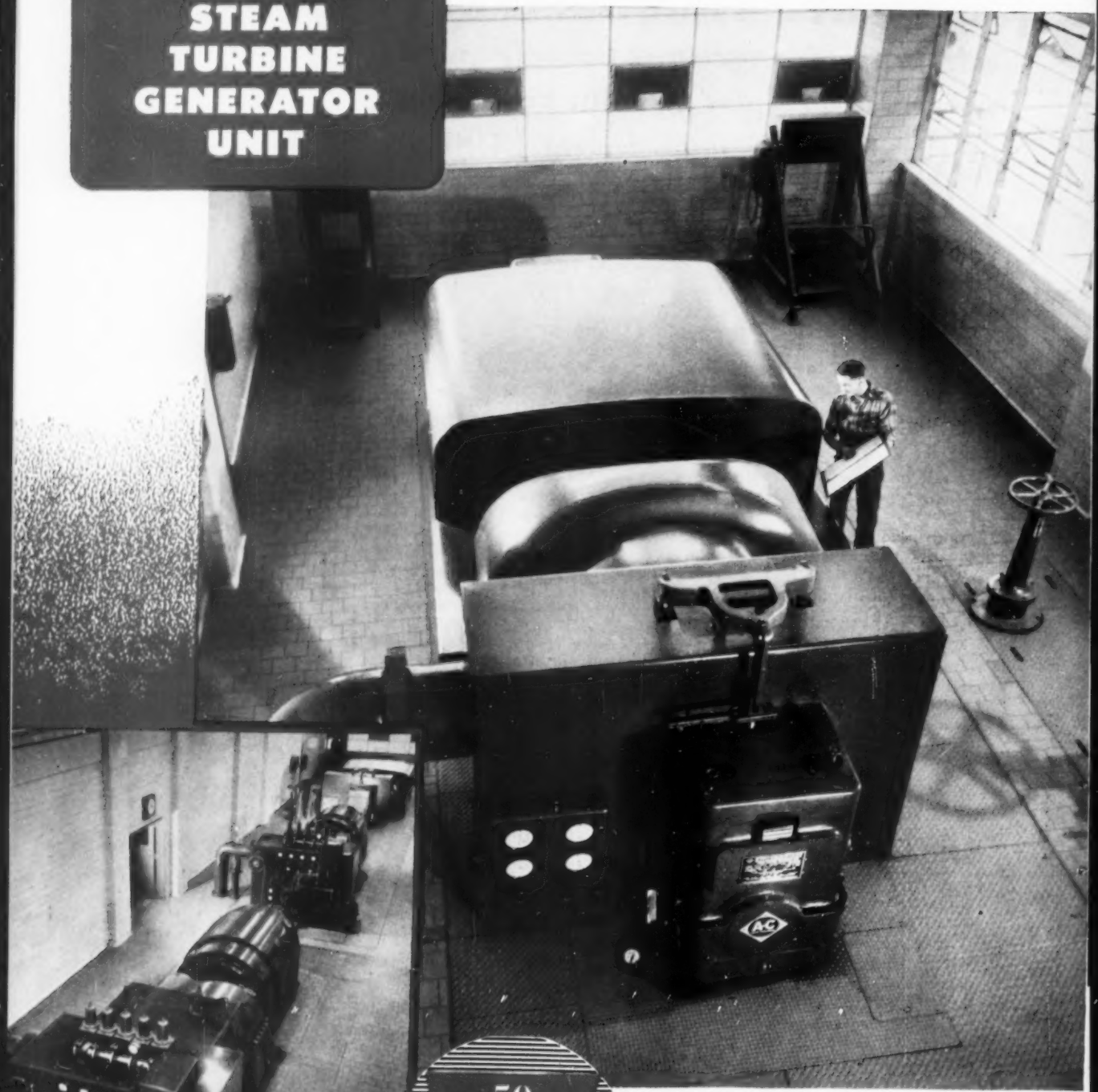
Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. Division McGraw Electric Company

For more data circle 509 on Post Card

Steam

WA-Series

STEAM TURBINE GENERATOR UNIT

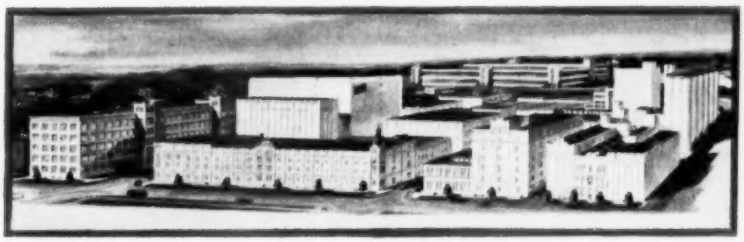


1896 50 1946
YEARS
TURBINE

ALLIS-

Works Twice

FOR WORLD-FAMOUS BREWER



Jos. Schlitz
Brewing Company
Uses Steam for Both Processing
and Power Generation

Great quantities of steam are required for production of the "beer that made Milwaukee famous" at a rate exceeding six million barrels of beer a year. With so much steam needed for process, the electric power needed for plant operation is generated as a by-product.

At the Schlitz home plant in Milwaukee, two Allis-Chalmers 2500-kw, automatic extraction condensing turbine-generator units have been supplying process steam and electric power for the past five years. Recently, when more generating capacity was needed to match rapid plant expansion, Schlitz again turned to Allis-Chalmers.

Now operating 24 hours a day, 7 days a week, the new 5000-kw turbine-generator shown here was installed in the space originally planned for a third 2500-kw unit. It consists of a condensing, automatic extraction, impulse turbine and a housing type, air-cooled generator and exciter all carefully engineered and manufactured to operate as an integrated unit.

Built for condensing or non-condensing service in NEMA standard ratings 2000 kw and larger, the modern WA-Series unit is designed to meet modern power plant requirements. Bulletin 03B7654 gives complete details. For your copy, just call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4269

WA-Series Features

For easy installation and maintenance, every detail of the unit is designed for maximum simplicity. Three-bearing construction; above-the-floor oil piping; bracket-bearing, housing-type air-cooled generator — all result in a compact unit that simplifies foundation requirements. Shipment of the turbine and the generator with their rotors in place further minimizes installation time.

Maximum reliability is assured by labyrinth spring-backed steam seals throughout, removable external glands, high chrome alloy steel buckets and nozzles, and time-proved governing system.

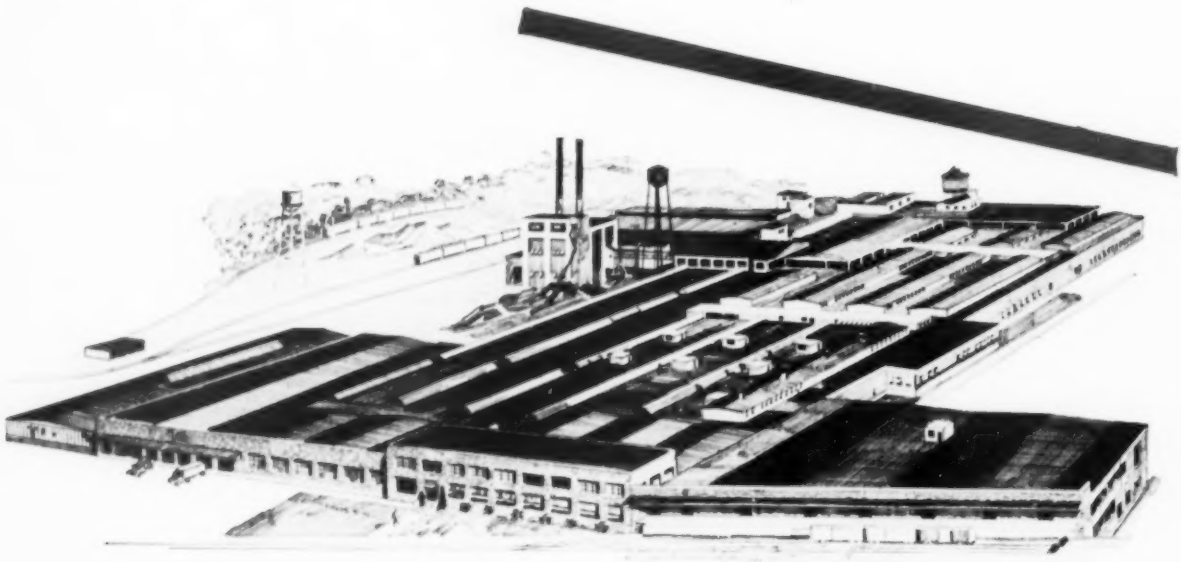
CHALMERS

A-C ALLIS-CHALMERS

For more data circle 510 on Post Card

one WICKES

generates steam in new B. F. GOODRICH



At the Oaks, Pennsylvania, tire and tube plant of The B. F. Goodrich Company, part of a $9,000,000 expansion program now in progress includes modernization of the plant's power facilities. A new WICKES 2-Drum Steam Generator (shown in the blueprint) will help supply the steam necessary in the production of the 3,500,000 tires per year at this new plant. The unit will produce 115,000 lbs. of steam per hour at 300 lbs. pressure. It is equipped with an air heater and super heater. Like so many other industries and institutions that depend on steam for heat and power, B. F. Goodrich knows that WICKES Boilers are a reliable source of low-cost steam. WICKES will design and build water tube steam generators for any practical size and pressure. WICKES also offers a wide choice of auxiliary equipment so that you get not only the best steam generator, but also the best correlated equipment. Consult your nearest WICKES representative or write us today.

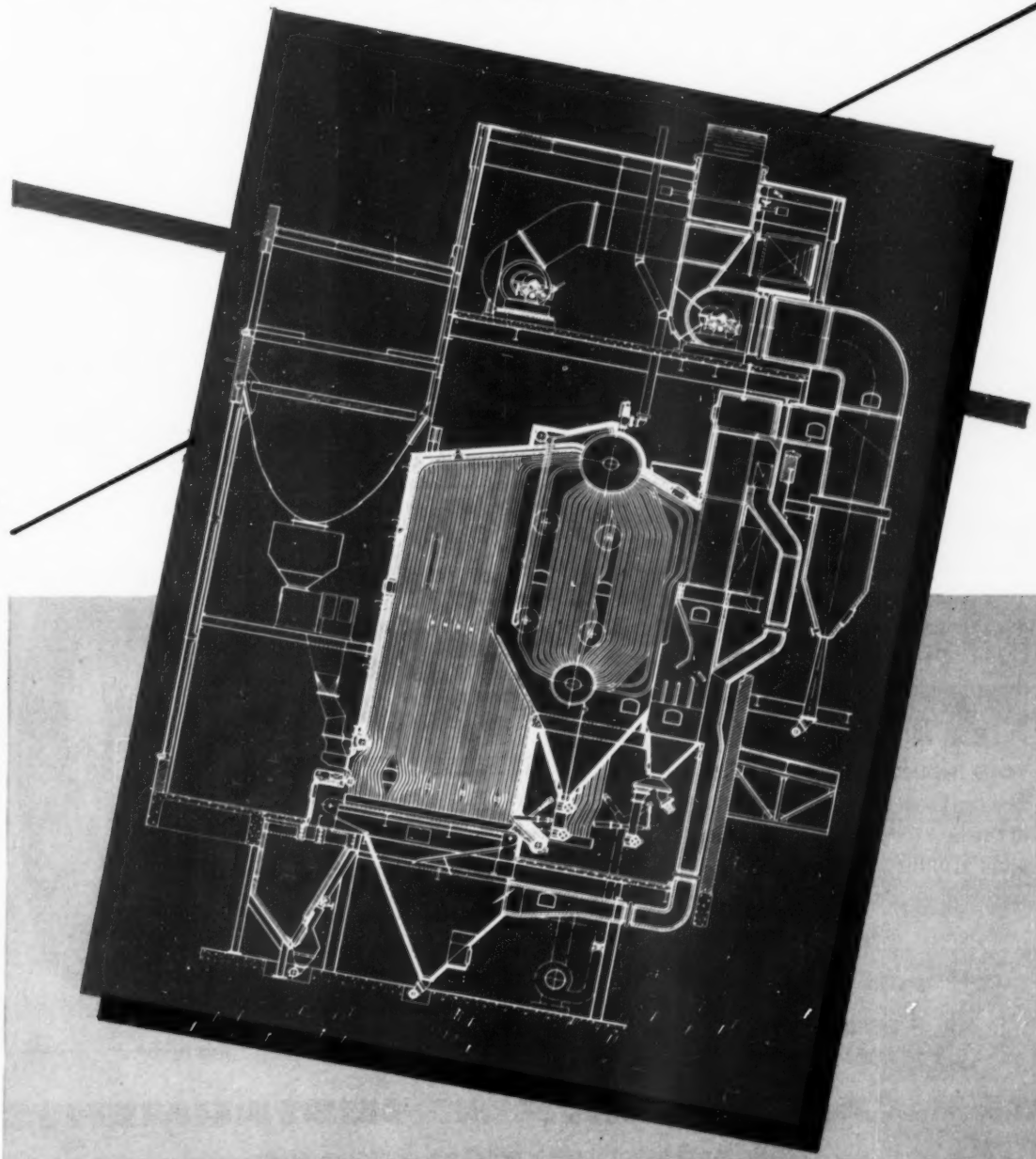
OUR 100th YEAR

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

two drum boiler

PLANT AT OAKS, PA.



RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES:** Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

156

For more data circle 511 on Post Card

By all indications **YOUR BEST BUY**

CLIMATE-PROOF CASE. Rain tight . . . snow tight . . . dust tight . . . sand tight . . . frost tight. The American Bi-Metal Thermometer can withstand submersion, hot blasts, dust, hot gases, extreme temperature changes and long exposure to the elements.

MAXIMUM RESPONSE — MINIMUM FLUTTER. Highly sensitive dampening fluid on bi-metal coil assures fastest response to temperature changes and greatest resistance to pointer flutter and destructive vibration.

ALL WELDED STEM CONSTRUCTION. Processing media cannot seep into case. Stem is stainless steel — corrosion-resistant — contributes to longer thermometer life.

Refineries, chemical and other processing plants find the American Bi-Metal Dial Thermometer "tops" for on-the-spot temperature readings.

Accurate

AMERICAN BI-METAL DIAL THERMOMETERS

Accuracy is guaranteed within 1% of the scale range. Application is simple and fast. Adequate clearance at back of case permits easy use of wrench during installation. Get complete information about these precision-built, long-life thermometers. Write for Bulletin 144.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. Take advantage of the broad experience of his organization and his ability to meet your most exacting requirements quickly from local stocks.

SPECIFICATIONS

Temperature Ranges: From minus 60° to 1000° F.

Dial Sizes: 3½" and 5". Graduations over full 270° arc.

Case: Aluminum alloy with smooth, black enamel instrument finish.

Bezel: Screwed to case.

Front: Heavy plate glass set in channeled gasket seals the case.

Pointers: Adjustable type attached with set screw; easy to get at for setting.

Connection: Fixed, ½" N.P.T.

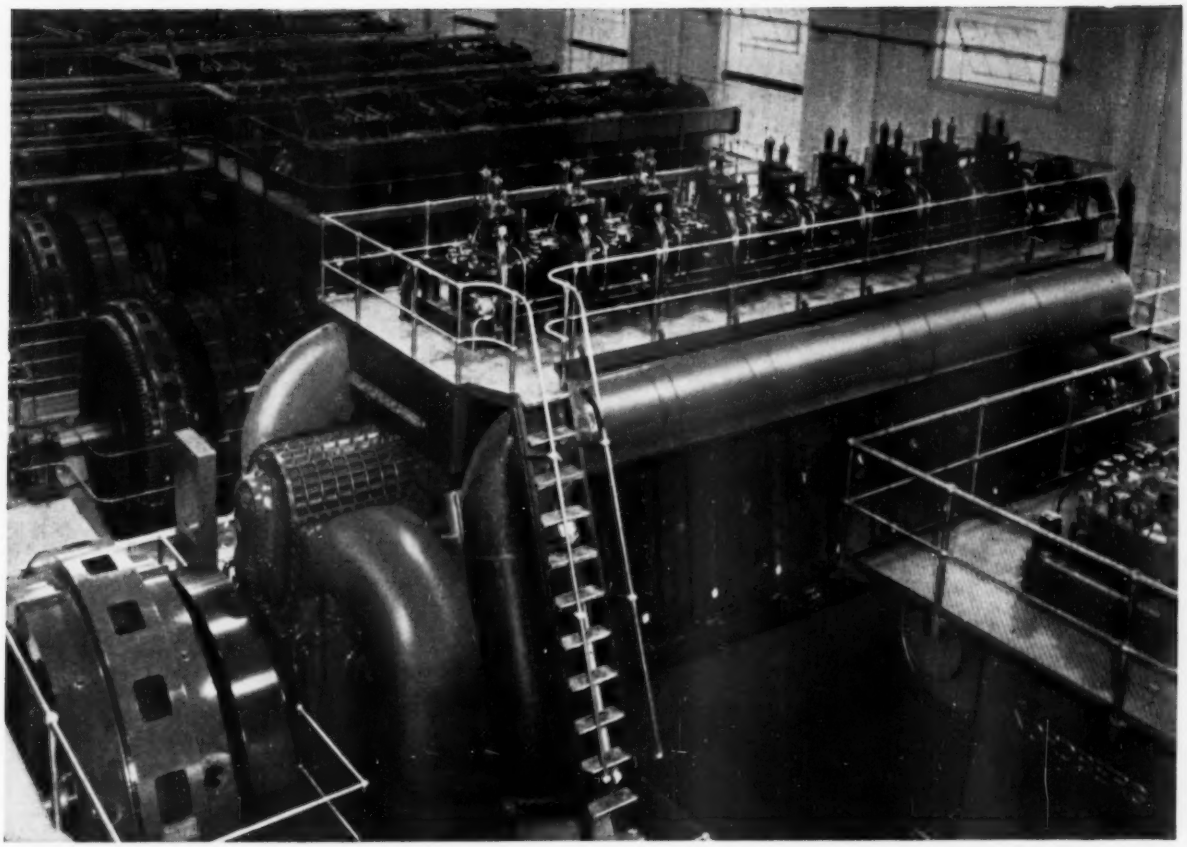
Separable Sockets: Available for use in closed systems or where the measured medium is corrosive to the stainless steel stem. Fit over all standard stem lengths except 2½".

AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

For more data circle 512 on Post Card



Largest Diesel Power Generating Station in the U.S.

reduces cylinder and piston ring wear with SHELL ROTELLA OIL

Electric power for the City of Grand Haven, Michigan, and the surrounding area, is generated by diesel engines in the largest municipal power station of its kind in the U. S. A. Shell Rotella Oil is the cylinder lubricant.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY
50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

For more data circle 513 on Post Card

Forest of Facts on Nalco® RECIRCULATING WATER TREATMENT

NALCO Laboratories' continuous research program has gathered this forest of facts about protecting recirculating water systems. In the search for the most effective *and economical* formula, the metal rods shown have been rotated in all types of recirculating waters and treating chemicals. Results pointed the way to a group of Nalco Treatments which assure users against scale and corrosion in virtually any recirculating waters. For details on Nalco Treatment to fit your particular system, call your Nalco Representative, or write direct.

Test rod from water treated with the Nalco 82 Method shows protective film and freedom from any scaling or corrosive attack.

THE Nalco 82 METHOD MAY BE THE ANSWER FOR YOU

The Nalco 82 Method is particularly suitable for scale and corrosion control in recirculating water systems which fall within the characteristic limits given here. Check them to see if your system should have Nalco 82 Treatment:

- Equipment to be protected contains steel and/or brass.
- Hardness of makeup water is more than 50 ppm; and sulphates and chlorides, as sodium salts, are less than 150 ppm.
- Calcium hardness of makeup can be as much as 500 ppm.
- Silica content of makeup water up to 50 ppm.
- Total alkalinity of makeup more than 40 ppm.
- Recirculation rates between 100 and 100,000 g.p.m.
- Where non-toxic waste water is required.

Act today to get the certain, low-cost protection of The Nalco System. Full data on Nalco 82 in free Bulletin 68.

NATIONAL ALUMINATE CORPORATION
6224 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM . . . Serving Industry through Practical Applied Science

For more data circle 514 on Post Card

HELPFUL BULLETINS

PROTECTIVE COATINGS

101 Data on Asphalt Mastics — This 12-pp article discusses composition and recommended applications of asphaltic mastic protective coatings. Provides an exhaustive description of the chemical and physical properties of mastics, and explanation of surface preparation and methods of applying asphaltic mastics. Graphs show degree of chemical resistance exhibited by them to 150 chemical substances. Emjay Maintenance Engineers.

102 Coatings for Insulation — Manual 545, 20 pp, is a revised reference manual on adhesives, sealers, vapor barriers, surface coatings for use with insulation. Gives technical product data, application specifications. Includes handy reference chart covering 31 products, giving information on uses, application, drying time, temperature limits, information on thinners. Benjamin Foster Co.

103 Cold Galvanizing Process — Volume 452, 8 pp, describes Galvicon, which may be applied by brush or spray to iron and steel surfaces to protect against corrosion. Discusses advantages of this cold galvanizing process over other means of corrosion protection. Details use on pipe lines, other applications, and describes methods of application. Chemical Div., Galvicon Corp.

104 Tank Lining — An insoluble cement lining to protect the inside of new and old hot water tanks and generators against corrosion and eliminate rusty water is described in this bulletin. Discusses application and gives advantages to be obtained. Metalweld, Inc.

WATER TREATING

105 Industrial Water Service — How this company is prepared to solve problems related to procurement, treatment, use and disposal of industrial water is told in this 10-pp booklet. Tells services and facilities available; discusses measures taken to solve some typical industrial water problems. Hall Laboratories, Inc.

106 Zeolite Softeners — Publication 4520-B, 32 pp, describes company's zeolite softener equipped with hydromatic single control valve. Accuracy, simplified operation and other advantages of this softener are stressed. Booklet provides detailed explanation of the sodium zeolite process; discusses factors in the sizing of equipment, the selection of zeolite material. Design and construction details of softeners are described and pictured, and some installations shown. Cochrane Corp.

107 For Water Treating Accuracy — Of interest to power engineers concerned with water treatment and waste treatment is 8-pp Bulletin 5421 on measurement and control of liquids by a pneumatic operated control system. Illustrates the system, describes basic elements and details its functions. General Filter Co.

108 To Keep Distilled Water Pure — Bulletin 131 describes manufacturer's Ventgard for protecting distilled water in storage from bacteria, dust, mist and gases including CO_2. Shows how Ventgard may be attached to Pyrex or metal storage tank to filter incoming air taken into tank as water is drawn off. Gives laboratory test results. Barnstead Still & Sterilizer Co.

109 Boiler Blowdown Control — Technical Paper No. 128, 10 pp, discusses principal types of boiler blowdown, also various control methods for producing pure steam and keeping heat transfer surfaces free of scale, other deposits. Tables give calculations for potential savings when using heat recovery equipment with continuous blowdown systems, and reduction in blowdown percentage. W. H. & L. D. Betz.

110 Continuous Blowoff Equipment — Bulletin 2391A, 12 pp, tells how manufacturer's automatic continuous blowoff equipment meets need of modern boilers for fuel economy, less blowoff and strain on metal, elimination of foaming and priming. The Permutit Co.

111 Industrial Chemicals — Application experience and potential uses of two chemicals are outlined in 5-pp Bulletin C-117-7. The products, Palcotan and Palconate, are reactive chemicals derived from redwood bark and declared effective as dispersing agents, replacement for tannins, as battery expander, boiler water treatment. The Pacific Lumber Co.

PUMPS, COMPRESSORS

112 Controlled Volume Pumps — Technical Paper 63, 8 pp, discusses installation and maintenance of controlled volume pumps. Describes correct procedure for connection of suction and discharge piping, flushing connections, breaking in packing. Trouble shooting chart lists most common difficulties; describes symptoms, causes, remedies. Milton Roy Co.

113 Centrifugal Pump Fundamentals — Form 7287, 12 pp, explains in nontechnical language and diagrams, the operating principles of centrifugal pumps. Defines terms used in pump calculations and works out some typical problems. Cameron Pump Div., Ingersoll-Rand Co.

114 Heavy-Duty Centrifugal Pumps — Bulletin W-341-B11B, 8 pp, describes saddle-mounted, vertically-split centrifugal pumps designed for continuous duty in all boiler circulation and heater drain services. Discusses construction materials, coverages available, pressure-temperature limitations; gives dimensions and specifications. Worthington Corp.

115 Centrifugal Pumps — Bulletin G-1000 presents the Chempump, a centrifugal pump designed for minimum maintenance. Cutaway illustration shows design details of this simplified pump and brief text discusses low installation costs, elimination of seals and stuffing boxes, wide choice of materials, other features. Includes dimensions, performance curves. Chempump Corp.

116 Plunger Pumps — Illustrated with photos, charts and drawings, Bulletin W-414-B45, 12 pp, describes three types of company's vertical triplex, single action plunger pumps, with 2- to 6-in. stroke. Discusses features, applications, ratings, dimensions. Worthington Corp.

117 Compressors, Vacuum Pumps — Bulletin 16B8126, 12 pp, explains operation, construction of manufacturer's single-stage water-cooled rotary compressors and vacuum pumps, described as applicable to every air or gas handling requirement. Cites savings in cost, gives specifications, typical air piping arrangement diagrams, proper accessories. Allis-Chalmers Mfg. Co.

118 Heavy-Duty Compressors — Bulletin A-72, 36 pp, gives construction, operation information on company's Class WN-114 heavy-duty air compressors. Illustrates seven models of compressor as a single unit for displacement capacities from 1186 to 1948 cfm, twin units furnishing up to 3896 cfm. Joy Mfg. Co.

ELECTRICAL EQUIPMENT

119 Motor Selection Aid — Bulletin B-2102, a 12-pp "motor selector" is designed to help power engineers choose squirrel cage induction motors from among manufacturer's new and current lines, for applications from 1 to 200 hp. Lists performance characteristics, construction features, dimensions, prices. The Reliance Electric and Engineering Co.

Postage-free cards for ordering these catalogs are provided on pages 113–114. When using them, don't forget to include your job title and company name —even if you want your catalogs to be delivered to your home address

120 Motor Starters — Booklet 1062, 16 pp, describes motor starters having short circuit protection for 2200- to 5000-v systems. Illustrates starters using company's 50,000 kva interrupting capacity type ZHS contactor; also starters which will safely interrupt the circuit from a bus of unlimited capacity. Indoor and outdoor installations are pictured. The Electric Controller & Mfg. Co.

121 Toggle Switches — Catalog 73a, 12 pp, covers 19 precision snap-action toggle assemblies and more than 90 "AN" and "JAN" approved designs, including assemblies that will control from 1 to 24 separate electrical circuits. Contains dimensions, operating characteristics, electrical ratings, contact arrangements on each switch, and an illustration of one representative switch from each group of switches. Gives general information on each "family" of switches, which are designed for low voltage d-c applications. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

122 Repetitive Manufacture Power Transformers — Bulletin GEA-6108, 40 pp, describes repetitive manufacture (built in accordance with ASA Standard C57.12a) power transformers. Cites application, features of standardized single- and three-phase units, from 501 to 10,000 kva. Includes price data, descriptions of optional features. General Electric Co.

123 Electrical Connections — Form 2759, 8 pp, catalogs manufacturer's Turnlok line. Sturdy construction, easy wiring, positive contacts, safety and other features of the line are stressed. Receptacles, connectors, caps are pictured and described along with dimensional data, ratings. Pass & Seymour, Inc.

124 Electric Power Drives — Application Tabloid Bulletin 185, 8 pp, presents 60 photos of manufacturer's electric power drives on various types of machinery and equipment. Includes application stories from metal, chemical, petroleum, plastic industries, and in heating and ventilating uses. Sterling Electric Motors, Inc.

125 Aperiodic Coupling — Brochure E-108, 8 pp, on aperiodic coupling units, coupling capacitors and potential devices, describes company's improved equipment for wide band coupling of carrier current signals to high-voltage transmission lines. Includes circuits of the network high pass filter and potential device, insertion loss characteristics, dimensions. Motorola Communications & Electronics, Inc.

126 Wire Wound Components — Catalog R-200, a 36-pp guide to manufacturer's electronic components, describes subminiature resistors, precision and power resistors, IF and RF transformers and coils. Tables and charts give specifications. I-T-E Circuit Breaker Co.

DUST, FUME CONTROL

127 Dust, Fume Control — Bulletin 3, 8 pp, contrasts the Dorfan dust and fume control system for collecting cupola dust "dry" with many other systems of cupola dust control, citing advantages of economy and simple operation. Mechanical Industries, Inc.

128 Blast Cleaning, Dust Control — Bulletin 1210, 24 pp, fully illustrated, describes manufacturer's line of blast cleaning and dust control equipment, accessories. It is indexed by equipment, type and purpose. Lists three methods of abrasive application, describes equipment using them. Pangborn Corp.

TUBING

129 Flexible Stainless Tubing — Bulletin STC-1 describes flexible stainless steel tubing developed to convey a wide variety of searching and corrosive liquids and gases at high temperatures. Data on types of construction, size and weight ranges, burst pressures, bending diameters, and fittings available for assemblies, are included. American Metal Hose Branch, The American Brass Co.

130 On Steel Tubing — Twelve-pp Form 1120 shows some of the many uses of steel tubing, and tells how it is made. Forming, standard finishes, cutting and machining are discussed and illustrated. Mechanical properties and specifications for manufacturer's steel tubing. Rochester Products, Div., General Motors.

. . . Outstanding Among This Month's Catalogs

131 V-Belt Engineering Data — With 32-pp Bulletin S-5132, anyone with an ordinary mathematical background can solve problems of selection, installation and service on almost any job where V-belts are used for power transmission. Includes recently approved hp ratings by the Rubber Manufacturers Assn. and others, and a comprehensive explanation of V-belt design. Standard sizes and pitch lengths of V-belts, groove dimensions for sheaves and rating tables are provided, and full data on steel cable V-belts included. Goodyear Tire & Rubber Co.

132 Water Conditioning Data Book — A new edition of this company's popular reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. This handy-sized, leatherette bound booklet is available to qualified power engineers. Please state your job title when requesting it. The Permutit Co.

133 Heat Exchanger Tubes — The full story of aluminum heat exchangers is told in this 24-pp booklet on aluminum heat exchanger tubes. Presents types of tubes and an explanation of corrosion protection provided by cladding; discusses successful application in various industries. A list of typical commodities handled or processed in aluminum equipment is provided. A section on fabrication, including general design data and alloy recommendations, and a technical section covering heat transfer, fluid flow, mechanical characteristics are included. Aluminum Co. of America.

134 Steam Condensers — Design and engineering features of company's condensers and facilities used in their manufacture are described in Bulletin 19B7987, 24 pp. Illustrates condenser types including conventional, single elbow, twin inlet, multi-steam path. Describes backwash systems for single- and two-pass condensers, air removal equipment for steam condenser service. Covers condensate and circulating water pumps in horizontal and vertical design, motors for pump drives. Allis-Chalmers Mfg. Co.

COAL HANDLING

135 Coal Stockpiling in Tight Spots — Field Report SND-206 covers the problem of stockpiling when only limited space is available. Tells how a 1½ cu yd scraper machine with monorail and trolley system does the job in a 193-by-112 ft storage area at a manufacturing plant. Includes photos and drawings of the system. Sauerman Bros., Inc.

136 Heat Drying of Coal — Book 2507, 8 pp, describes research on manufacturer's Multi-Louvre dryers for drying and pelletizing fine coal. Gives drying characteristics of coal with 20 per cent moisture content, amount of pelletization possible. Link-Belt Co.

INSTRUMENTS AND CONTROLS

137 Control Center Installation — Bulletin F 5265-1, 8 pp, tells how to improve the installation of controls for heating, ventilating and air conditioning with company's automatic electric Control Center system and electric automatic controls. Stresses advantages of a centralized system. Compares other methods of preparing electric control layouts with simplified control center wiring diagram. Barber-Colman Co.

138 Recording, Controlling Instruments — Catalog M-2-A, 48 pp, illustrates, discusses manufacturer's entire line of mechanical industrial instruments, including fixed stem and distant reading dial thermometers, temperature and pressure recorders, controllers, diaphragm motor valves. Includes price list. Weston Electrical Instrument Corp.

139 Industrial Thermometers — Fourteen-pp Catalog 101 describes and pictures company's Gotham line of thermometers, including the Multi-Angle which can be rotated and tilted to practically any position. Includes temperature equivalent table. U. S. Gauge Div., American Machine and Metals, Inc.

140 Valve Actuators — Bulletin 3020, 8 pp, describes plug valve tandem type actuators for valves requiring relatively high torques to operate and floating bar type for valves needing lower operating torques. Shows actuator selection table, typical applications, dimensions and weights, mountings. Ledeen Mfg. Co.

141 Gages and Valves — Catalog 236, 8 pp, covers company's complete line of liquid level gages and valves with condensed presentation of data and specifications. Includes illustrations of standard, special function equipment, steam ratings of gages, dimensional drawings, construction features. Jerguson Gage & Valve Co.

142 For Controlled Heating — Sixteen-pp Bulletin 540 describes the Selectotherm, a means of automatically controlled heating in which a single dial control "tunes in" with the weather. Stresses comfort afforded, economy and simplicity of the system, gives engineering details on component parts. How the system functions is explained and performance evaluated, and several buildings in which the system has been installed are pictured. Illinois Engineering Co.

143 Filter Control — Bulletin 480-L1, explains operation, sequence protection, flexible controls of manufacturer's Auto-Central filter control for backwashing rapid sand water filters. Schematic drawing included. Builders-Providence, Inc.

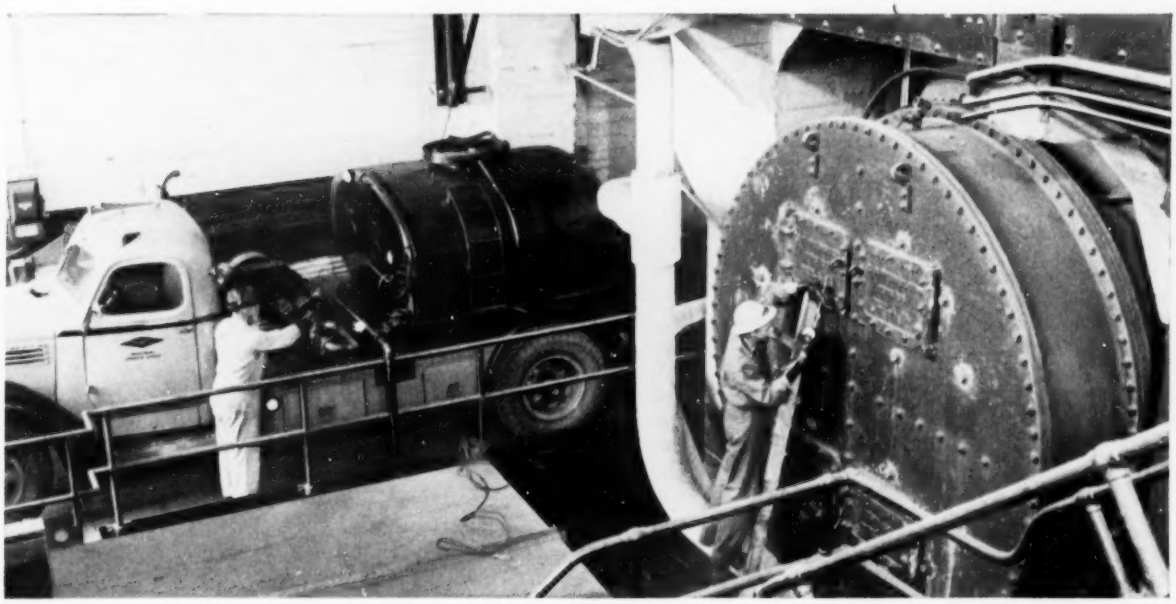
144 Television Equipment — Twenty basic applications for "TV Eye" low-cost closed circuit television equipment are described and pictured in Form 3R2335. Folder explains equipment's functions and operation, lists specifications. Radio Corp. of America.

WELDING

145 Manual on Welding Aluminum — Latest developments on all practical methods for welding aluminum are

CHEMICAL CLEANING SAVED 400 TONS OF COAL PER YEAR

Fly ash, soot and carbonate deposits removed from condenser by Dowell; vacuum increased



Fly ash and carbonate deposits on the water side of an 800-KW turbo surface condenser had reduced vacuum from a normal 28″ to 24″. The temperature of the water leaving the condenser had dropped from 95°F. to 85°F.

These deposits were removed by Dowell Service with specially prepared liquid solvents. Result: the condenser was restored to its normal operating efficiency. The steam requirement was reduced by 2.5 pounds per kilowatt hour. On the basis of 8,000 hours of yearly operation, the plant engineer calculated a saving of at least 400 tons of coal per year.

Dowell chemical cleaning methods can be used on hundreds of different kinds of industrial equipment. Engineers especially trained for this kind of work do the job for you. They apply solvents according to the technique demanded by the job: filling, spraying, jetting, cascading or vaporizing. Dowell liquid solvents can go wherever steam or water will flow, reaching places inaccessible to other cleaning methods. Scaffolding is unnecessary. Dismantling and downtime are kept to a minimum.

A call for Dowell Service will bring experienced personnel to your plant within a few hours with all necessary chemicals, pump trucks and control equipment. For complete information and estimates on the cleaning of your equipment, contact the nearest Dowell office, or write directly to Tulsa, Dept. H-24.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

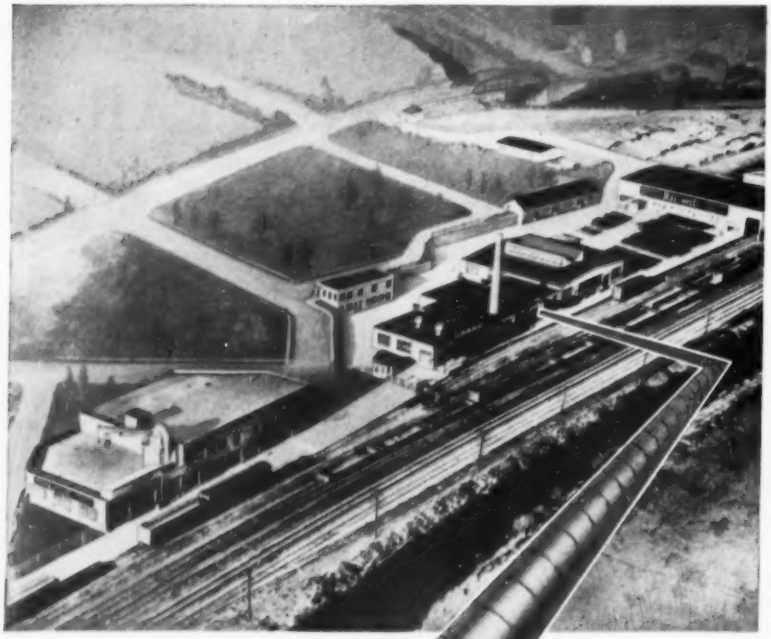
Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

For more data circle 515 on Post Card



NEVER ENDING LINE OF

Quality

The Ric-wil Company represents over 40 years of manufacturing Quality Insulated piping systems. The complete Ric-wil product line is continuously pre-proven by laboratory and field tests to maintain this superior quality.

Contact your local Ric-wil representative or write direct for Catalog No. 5401.

Send for Catalog 5401

Quality Piping Systems of the . . .
. . . Highest Thermal Efficiency

RIC-WIL PREFABRICATED INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY
BARBERTON, OHIO

For more data circle 516 on Post Card

covered in this generously illustrated 176-pp booklet. Treats torch, arc, resistance and pressure welding, giving special attention to selection of methods, performance of welds, welding of castings and control of welding quality. A final section contains 32 comprehensive tables giving important data on welding aluminum. Tables cover physical properties of company's alloys, alloy compositions and strengths of welds. Booklet is available to qualified power engineers, please give your job title when requesting it. Aluminum Co. of America.

146 **For Hard-To-Weld Metals** — Catalog ADC 709B, 16 pp, explains features of company's Heliwelding (tungsten arc welding) process and the equipment used with it. Describes, shows in operation, manual holders, machine holders for use with semi-automatic equipment, others. Shows automatic hardfacing process using vibratory feeder, accessory equipment including control panel, filler wire feeders, control stations. Air Reduction Sales Co.

MECHANICAL POWER TRANSMISSION

147 **Improved FHP Drive** — Catalog M-543, 24 pp and illustrated in color, describes the design of company's new FHP Vari-Speed Motodrive. Besides outlining operating features of the drive, booklet lists prices for all units, controls and modifications. Also discusses the "threaded" spiral groove lubrication utilized. Includes instructions on how to select proper unit; gives ratings, dimensions and assemblies. Reeves Pulley Co.

148 **Sprockets, Couplings** — Up-to-date information on Gripmaster sprockets, flexible couplings and steel "weld-on" hubs is given in 16-pp Bulletin 184. Providing photos, sizes, price lists and instruction data, the booklet also includes sections on uses, advantages, flexibility of an interchangeable bushing system. Cullman Wheel Co.

149 **Sprockets, Roller Chains** — Bulletin A-632 (a 4-pp supplement to company's Bulletin A-624) gives technical data, prices for company's entire Taper-Lock line of sprockets and chain for sizes from 40 through 160, pitch range from $\frac{1}{2}$ through 2 in. Tables give dimensions, number of teeth, sprocket and bushing numbers, weights, bores, keyseats; also data on riveted and cottered roller chains, and roller chain pin extractors. Dodge Mfg. Co.

VALVES, PIPING ACCESSORIES

150 **Steel Gate Valves** — Five types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 B, 12 pp. Material specifications, dimensions are given, also non-shock service pressure ratings. Manning, Maxwell & Moore, Inc.

151 **For Lighter Pipe Loads** — Bulletin 154 describes the Junior Counterpoise pipe hanger designed for a light load and long travel constant support. Tells applications in which this simple and compact hanger is particularly suited, gives features of the unit. Includes dimensional drawings. National Valve and Mfg. Co.

152 **For Hot Underground Pipes** — This 20-p technical data manual on

Just name the valve needed--
Powell can supply it!

You'll find just the valve you need in the complete line of Powell Valves. For Powell probably makes more kinds of valves—and has solved more valve problems—than any other organization in the world.

And Powell Valves have a record of dependable flow control since 1846.

Powell Valves are made ⅛" to 30" and 125 pounds to 2500 pounds W.S.P. Bronze, iron, steel and corrosion resistant alloys. Available through distributors in principal cities. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

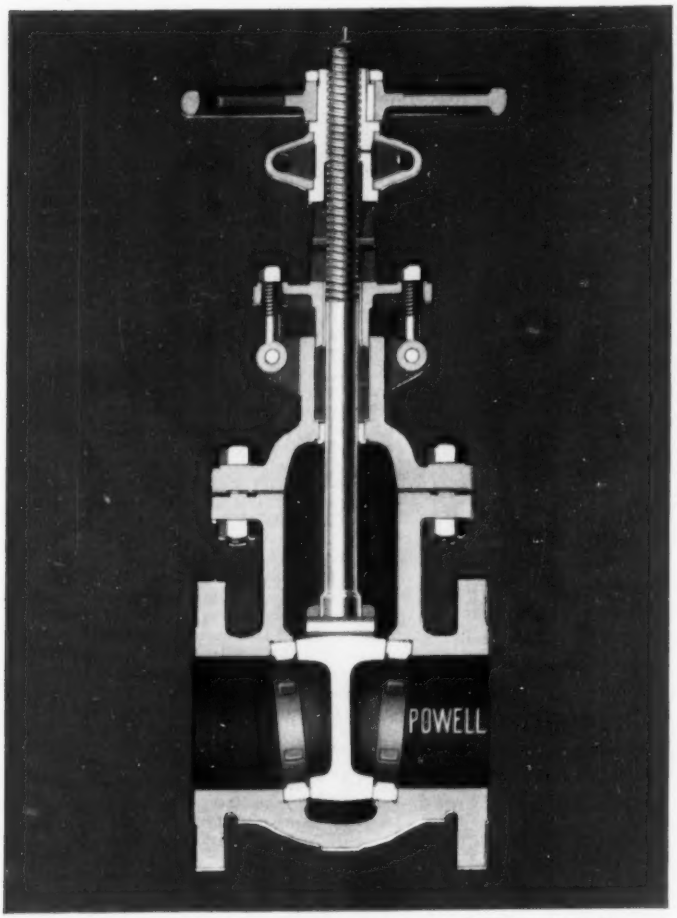


FIG. 1503 (*sectional*) **—150-POUND CAST STEEL GATE VALVE.** Flanged ends, bolted flanged bonnet with outside screw rising stem and yoke. Solid wedge. Available in sizes 1" to 24", inclusive.

FIG. 11303—1500-POUND PRESSURE SEAL CAST STEEL GATE VALVE. Many proven advantages and exclusive features. Pressure Seal Valves are also available in Non-Return, Check, Globe and Angle Patterns for 600, 900, 1500, 2500 pounds.

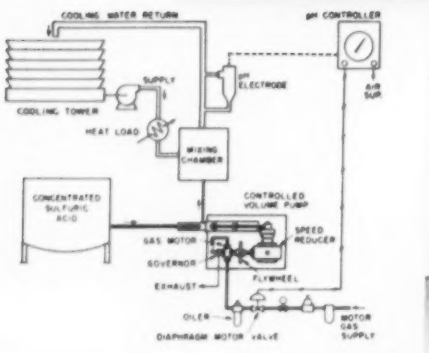
FIG. 1331-A—1500-POUND INTEGRAL BONNET OFFSET GLOBE VALVE. One-piece construction eliminates possibility of leakage between body and bonnet. Sizes ½" to 2", inclusive.

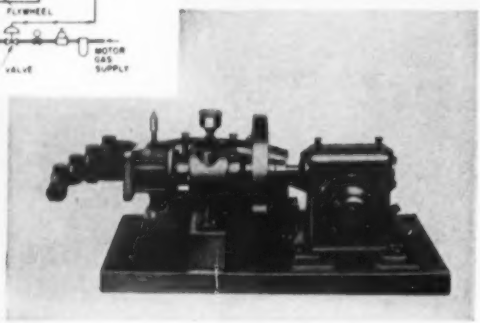
CONTROLS FOR THE LIFE LINES OF INDUSTRY

Powell Valves 108th year

For more data circle 517 on Post Card

CONTROLLED VOLUME PUMPS ARE FLOW-CONTROL INSTRUMENTS





Here's how close pH control helps extend cooling tower life

As final control elements in automatic pH control systems, Milton Roy Controlled Volume Pumps solve a basic low-capacity flow control problem. In the system shown, for instance, these pumps meter 98% sulfuric acid to cooling tower water automatically on demand. Optimum pH control is assured, minimizing chemical or biological attack and delignification of the wood of the cooling tower.

Other applications in water treatment include systems for internal or external treating, for scale and corrosion prevention, precipitation of salts, removal of dissolved oxygen.

See how Milton Roy Controlled Volume Pumps can solve *your* low-capacity flow control problems. Milton Roy's engineering service includes —at no extra cost—proper instrumentation, panelboard design, sizing of equipment and all other engineering details.

Engineering Representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa

MILTON Roy COMPANY

Manufacturing Engineers 1320 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

For more data circle 518 on Post Card

Gilsulate insulation shows how it serves to insulate and protect hot underground pipes. Explains its three-zone protection feature, discusses Gilsulate grades, and tells how to determine ditch size for pipe installation. Performance data are presented in detail and photos show how it is applied. American Gilsonite Co.

HEATERS, HEATING

153 Hot Water Storage Heater — Catalog 18, 48 pp, illustrated in color, pictures, describes company's line of hot-water storage heaters, presents information on piping arrangements, installation data. Horizontal and vertical heaters cataloged as to weights, dimensions, construction, capacities — with conversion tables. Includes piping diagrams for high and low pressure steam systems, step-by-step guide for setting up and connecting a storage heater. Gives average water requirements of typical hot water fixtures in various types of buildings, showing how hot water capacity requirements may be calculated. The Patterson-Kelley Co., Inc.

154 Data on Blast Coils — Valuable handbook data on indirect heating is offered in 24-pp Bulletin CH-532. The Chinook principle of a "pipe within a pipe" is fully covered, and also included are tables of heater capacities, performance curves, physical data, casing dimensions, friction losses and steam properties. Bayley Blower Co.

OTHER EQUIPMENT

155 Custom Engineered Equipment — More than 40 representative examples of equipment built by this manufacturer for power plant, chemical plant and refinery installation are presented in 12-pp Bulletin E-1. Included are heat exchangers, steam generators, refrigerating machinery, reactors, other equipment. Henry Vogt Machine Co.

156 Hot Water for More Power — This 6-pp leaflet explains how high-temperature water steps up efficiency and produces more power. Shows hot water (250 to 400 F) as economical heat carrier when used as a heat recovery and distribution medium with power producing plants; possibility of obtaining more power through regenerative heating than by equivalent steam plants. American Hydrotherm Corp.

157 Chemical Porcelain — Bulletin 438, 24 pp, describes, catalogs company's line of chemical porcelain equipment for process applications, including Y and angle valves, safety valves, plug cocks, pipes and fittings. Describes Tufclad armoring, application and specifications. Gives installation, operating recommendations. Process Equipment Div., Lapp Insulator Co., Inc.

158 Diesels and Engines — Bulletin J-73, 16 pp, describes manufacturer's type JS engines. Gives specifications on complete line of 13-in. bore and 16-in. stroke diesel, gas-diesel and spark-ignited gas engines. Includes cutaway drawings showing engine detail, performance charts of atmospheric and supercharged engines. The Cooper-Bessemer Corp.

159 Shutdown Safeguards — "Laying Up Equipment" is a 6-pp folder devoted to the problem of safeguarding steam boilers, turbines and other water-us-

When a man makes his choice between two equally fine guns, he knows that, in the field or at the traps, there still will be . . .

. . . ENOUGH DIFFERENCE TO MAKE *ALL* THE DIFFERENCE

The same thing is true of many equipment purchases he makes for his business . . . heat exchanger tube being no exception. Many Scovill customers, for example, will tell you that Scovill's ultra-modern Continuous Casting process makes all the difference in the performance of our Phosphorized Admiralty Heat Exchanger Tube. The material is sounder . . . more uniform in chemical composition. Phosphorus content is uniform, optimum, most effective.

Scovill's outstanding Technical Application Services frequently give recommendations that make *all* the difference in the way a tough installation pays out. The potential savings are well worth looking into. Ask us to prove it. Scovill Manufacturing Company, 99 Mill Street, Waterbury 20, Connecticut Phone Waterbury, Plaza 4-1171.

SCOVILL
HEAT EXCHANGER TUBE

Phosphorized Admiralty ★ Admiralty ★ Arsenical Admiralty ★ Muntz Metal ★ Naval Brass ★ Red Brass, 85% ★ Deoxidized Copper Arsenical Copper ★ Copper Nickel, 10% & 20% ★ Cupro Nickel, 30% ★ Aluminum Brass ★ Aluminum Bronze, 5% ★ Duplex Tube

7SC54R

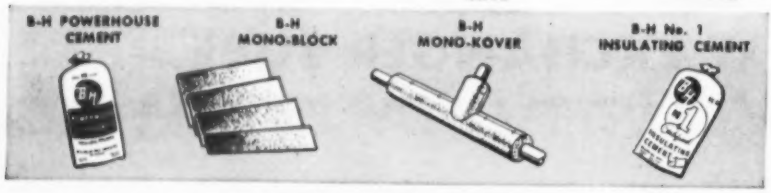
For more data circle 519 on Post Card

What every reader of *Power Engineering* should know . . .

- Extra Light Density
- Easily Cut and Fitted
- Six Foot Lengths
- Resilient, Flexible
- Won't Break or Crumble
- Easy to Paint
- Highly Efficient
- No Coarse Fibers
- Takes Rough Handling
- Easily Nested
- Non-Corrosive
- Won't Rot, Decay, Mold
- Lower Applied Cost
- Factory Applied Vapor Barrier

Baldwin-Hill COMPANY
208 BREUNIG AVE., TRENTON, N. J.
Kalamazoo, Mich. • Huntington, Ind. • Temple, Tex.

Send for bulletin with data on how to apply, properties, selection help, sizes and thicknesses available



For more data circle 520 on Post Card

ing equipment when "laid up" during shutdowns. Cites examples and suggests various methods used for protecting such equipment. Hall Laboratories, Inc.

160 Velocity Stage Turbines — Bulletin 4202, describes velocity stage turbines for mechanical drives, operating under steam conditions up to 600 psig and 750 F. Cutaway drawing shows design features. Lists specifications, features and accessories, dimensions. De Laval Steam Turbine Co.

161 Insulating Brick — Bulletin ED-B, 12 pp, contains data on six classes of insulating brick from 1600 to 3000 F. A thermal chart gives heat losses, heat storage capacities, cold face temperatures for insulated walls of various combinations, hot face temperatures of 1200 to 3000 F. F. Harbison-Walker Refractories Co.

The new and revised publications reviewed on these pages offer help on many operating and maintenance problems. To order them, use the Reader Service Cards on pages 113–114. Use the cards to ask for advertised catalogs, too

162 Skip Hoists — Sixteen-pp Bulletin 110 provides sequence views of operation of weigh type and plug feed loading gates. Lists capacities of various size buckets, traveling various lifts at various speeds. Describes hoist engines, sheaves, head frames and counterweights. The C. O. Bartlett & Snow Co.

163 All About Wiping Cloths — Now available is a handy chart rating 21 basic types of cloths according to wiping qualities. Gives information on absorbency, weight, softness, durability, lintlessness, weave, size and suggested uses. Covers cloths for general wiping, polishing, greasework, cleaning hands, etc., makes it easy to find the right one for the job. Charles Belsky & Sons, Inc.

164 Air Conditioners — Ceiling-mounted and floor-mounted central station units for year-around air conditioning are described in Bulletin C-1100-B33B, 8 pp. Gives specifications, dimensions, accessories, physical data; tells advantages of sectional construction for easy handling and interchangeability. Worthington Corp.

165 Ductile Cast Iron — Bulletin DI-1, 12 pp, with illustrations, graphs and charts describes ductile cast iron, said to combine process advantages of cast iron with engineering properties of cast steel, listed as strengths up to 120,000 psi, considerable ductility, and resistance to heat and wear. Indicates potential applications for this metal in many fields. International Nickel Co., Inc.

166 Facts About Oil — This new edition of "Facts About Oil," a 32-pp reference book containing up-to-date statistics and data on the petroleum industry, discusses origin, exploration, transportation, marketing and supply and demand. Single copies will be sent to qualified power engineers, please state your title. American Petroleum Institute.

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 2 | AUGUST 1954 | Number 4

Investigation from the Ground Up

A recent experience in a large utility plant took Hall Service engineer R. G. Hobek from the basement to the roof to investigate the connection between contaminated boiler water and a peculiar odor that was permeating the entire building.

The No. 2 unit of this plant is rated at 700,000 pounds per hour and is operated at 1500 pounds per square inch. Favorable operating conditions in the equipment at this power station are scrupulously maintained, so the plant men were disturbed when an unusual color showed up in water samples drawn from this boiler. At about the same time, a heavy odor became noticeable throughout the plant.

Mr. Hobek reports:

"We noted the heavy, sweet, organic odor as soon as we entered the building. When the boiler water was checked, it was found to contain a yellowish, well-dispersed material that would not settle, and could not be removed by ordinary filtration.

"We started our examination of the system at the condenser vacuum pump vent line in the basement where the odor was first noted. We followed the line to the roof where it exhausted. In observing the vent lines from the No. 1 and No. 2 units, we saw that the exhaust from the No. 1 unit rose directly to atmosphere while that from the No. 2 unit appeared to be heavier than air and seemed to flow down the outside of the vent line. We climbed to the roof and found that the odor of this heavy exhaust was the same as in the plant. An oily film coated the outside of the vent line.

"The ventilator intake for the plant is located about 50 feet from the vent lines. The fumes were being picked up here and carried throughout the plant.

"We suspected at this point that oil contamination would show up in the condensate and a sample was collected. Analysis of the sample confirmed our suspicion, and investigation by plant personnel showed that a broken weld on the turbine bearing oil return line had admitted from fifty to one hundred gallons of oil to the system."

Cleaning the oil from the system was a big job, but the early solution of the problem prevented real damage.

Waste Water Can Be Costly

Two recent civil suits could have been avoided by proper disposal of waste materials. The outlay for damages and court costs took these plants "off the hook" legally but did not solve their problems.

One plant dumped a water and molasses mixture into a ditch from which it seeped into a well supplying drinking water. The Supreme Court of the state upheld a substantial judgment against the plant, commenting ". . . one who by permitting pollution contaminates the underground water supply of his neighbor's well or spring, commits an act for which he may be required to respond in damages."

Another plant dumped water saturated with a mixture of dirt, chalk and chemicals into a stream. In sustaining an injunction against the continuance of this practice the Supreme Court of this state said, "The principle is that while water is on the land it belongs to the owner of the land, yet he cannot so use and adulterate it as to interfere with the enjoyment thereof by the next owner and if he does so, he is liable in damages for so using it."

Plant-wide Survey Pays Off

The cooling of precious metal bushings presented a critical problem for production and maintenance engineers in a fiber glass plant. Make-up to the open recirculating cooling system was untreated well water; the high "skin" temperatures encountered in the cooling system aggravated the corrosive and scale-forming properties of this water. Plugging of the restricted cooling channels, resulting in overheating of bushings, was a daily occurrence. Aside from production losses, damage to the bushings was often so extensive that recasting was not possible. New bushings cost several thousand dollars apiece.

A plant-wide water survey by Hall engineer W. J. Reese showed the cooling problem to be sufficiently critical to justify split stream softening followed by treatment with a few ppm of glassy phosphate at a controlled pH. Since adopting this recommendation, the plant has operated continuously for two years without one instance of bushing failure resulting from overheating; this service record exceeds the calculated life expectancy of the precious metal bushings by many times. Probably the life expectancy of the Plant Engineer has also been materially improved.

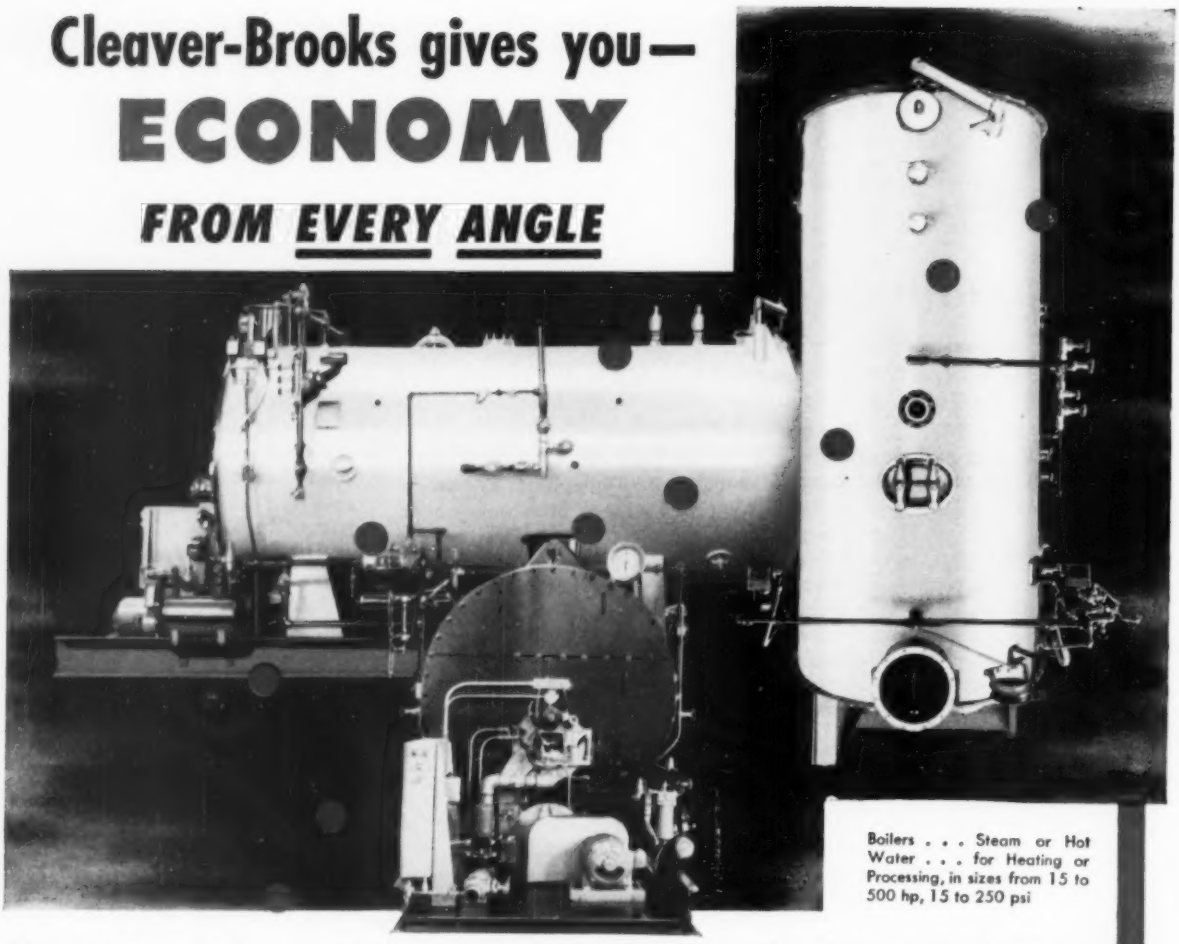
Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information, write, wire or call Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

Water is your industry's most important raw material. Use it wisely.

For more data circle 521 on Post Card

Cleaver-Brooks gives you—
ECONOMY
FROM EVERY ANGLE



Boilers . . . Steam or Hot Water . . . for Heating or Processing, in sizes from 15 to 500 hp, 15 to 250 psi

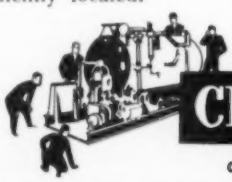
Use this guide to plan present and future boiler installations

Here are basic reasons why Cleaver-Brooks self-contained boilers SAVE money wherever installed. Remember these advantages when expanding your present plant or replacing obsolete boilers. For complete details, write for catalog AD-100, Cleaver-Brooks Co., Dept J, 310 E. Keefe Avenue, Milwaukee 12, Wisconsin, U.S.A. — *Cable address: CLEBRO — Milwaukee — all codes.*

- **SAVES FUEL** — greatest efficiency and fuel economy through high-heat transfer of four-pass, forced draft boiler design.
- **SAVES SPACE** — boilers are compactly self-contained. Use less boiler room area. Fit into low headroom locations.
- **SAVES SERVICE** — factory assembled with trouble-free, quality components. Tested and backed by Cleaver-Brooks' one-source responsibility. ASME code constructed.
- **SAVES MAINTENANCE** — oil, gas or combination oil/gas firing eliminates bulky fuel handling. Designed for easy cleaning and inspection.
- **SAVES EXPENSE OF SPECIAL EQUIPMENT** — boilers available for hot water or steam service . . . heating or processing applications.
- **SAVES INSTALLATION COSTS** — no special foundation needed. Set boiler on existing concrete floor. Simple, roof-high vent eliminates costly smoke stack. Service connections conveniently located.
- **SAVES THRU FUEL FLEXIBILITY** — uses most economical and available fuel in your area. Exclusive burner permits 10-second gas/oil interchange.
- **SAVES BY QUICK STEAMING** — meets fluctuating steam loads automatically. Electronic controls start and stop burner. Safety controls assure 100% protection.
- **SAVES MANPOWER** — fully automatic operation. All controls easily accessible and all normal maintenance can be done by men without special training.
- **SAVES PLANNING TIME** — standard design in 15 to 500 hp; 15 to 250 psi gives you custom planning for single or multiple units.

IT PAYS TO PLAN FROM *ALL* ANGLES TO GET GREATEST BOILER ECONOMY — PLAN WITH CLEAVER-BROOKS — WRITE FOR DATA TODAY

"It's NEW — get the facts on the CB boiler — write today!"



Cleaver Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER

For more data circle 522 on Post Card

KIRK AND BLUM

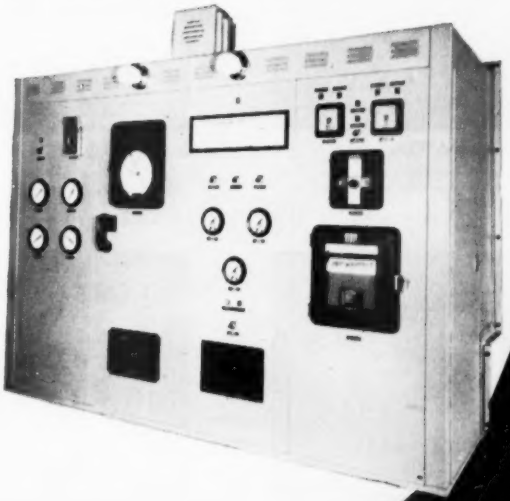
CONTROL PANELS and DESKS

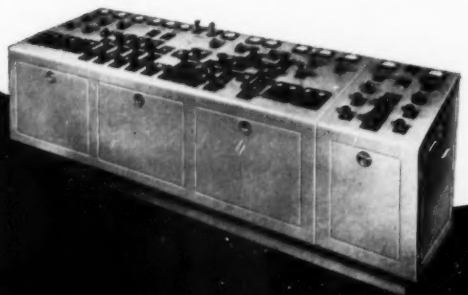
for INDUSTRIAL PLANTS and UTILITIES

For fabrication of control panels, desks and consoles, in any size, in any quantity . . . for any power plant requirement, call on Kirk & Blum.

Steel and alloy fabrication . . . sheets, plate and light structurals . . . has been a Kirk & Blum specialty for more than 47 years. Exceptional experience and complete facilities up to ½" in steel, stainless, aluminum, monel and other alloys.

Send prints for prompt quotation or write for your copy of the latest Kirk & Blum Sheet and Plate Fabrication catalog. The Kirk & Blum Mfg. Co., 3230 Forrer St., Cincinnati 9, Ohio.



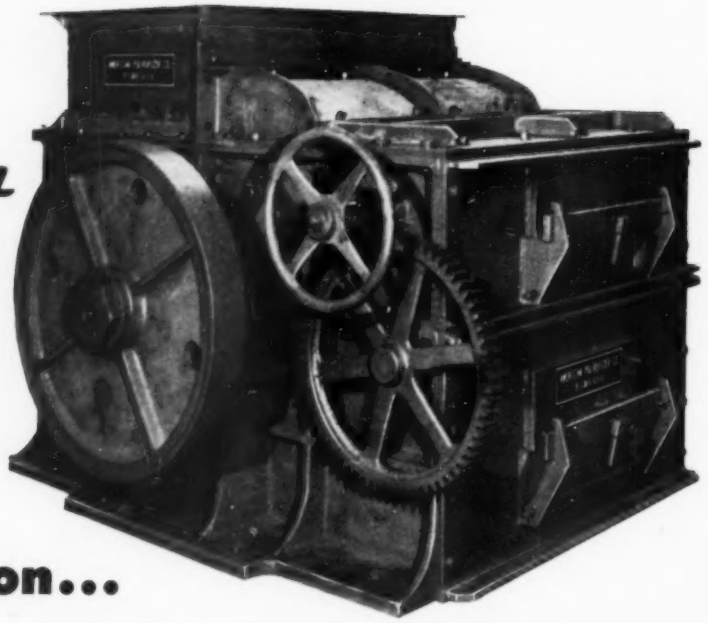


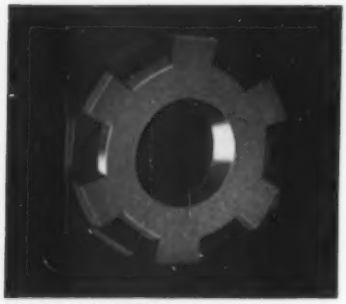
KIRK AND BLUM

SHEET METAL FABRICATION

For more data circle 523 on Post Card

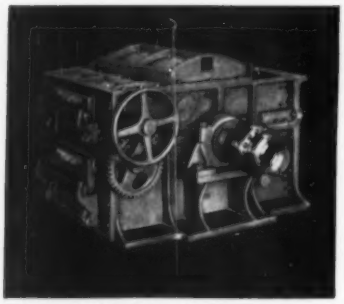
5 reasons why *American Crushers* can reduce coal for less than 10¢ per ton...





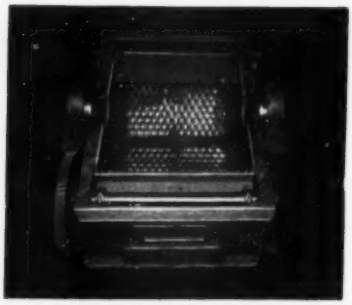
1 Patented Shredder Ring

American-originated feature that splits coal instead of smashing it—for uniform sizing, minimum fines. Result: Americans run at slow speeds, with savings in power and maintenance. No cams, shear pins, toggles.



2 Heavy-Ribbed Steel Frame

Bearing pedestals are cast integrally with tower side frames. Sectional design for easy dismantling . . . abutting joints accurately machined and bolted together for dust-tight fit.



3 Completely Lined Crushing Chamber

Heavy, renewable liners . . . sectional for easy plate-at-a-time replacement . . . engineered to offer life-time protection to the frame.

4 Complete Accessibility to Adjustment and Parts

All adjustments external—even with crusher in motion. Rotor easily reached by removing top section. Rings readily reversed or replaced. Liners quickly reached, too, for periodical inspection.

5 Custom-Built to Your Needs

American has developed many crusher types, each in a number of sizes. Custom-designed with the proper crushing elements, grate bars or screen plates to produce the desired product in the quantities required.

They All Add Up!

Whenever you figure cost per ton, the best answers come from American. By actual survey, American Crushers, in use an average of ten years, show a parts replacement cost of only 1/10th of 1¢ per ton of coal crushed!

American **PULVERIZER COMPANY**

Coal Crushers up to 800 Tons Per Hour • Laboratory Crushers up to 2,000 Lbs. Per Hour

Originators and Manufacturers of Ring Crushers and Pulverizers

1431 MACKLIND AVE. • SAINT LOUIS 10, MO.

For more data circle 524 on Post Card

For *Long Service* Life

...B&W Carbon Steel Pressure Tubing

The collection of qualities found in B&W Carbon Steel Pressure Tubing, Seamless or Welded, adds up to the all-important end result of long service life.

No less important are the "pre-operating" qualities like uniform ductility, accuracy of dimension and ease of fabrication and installation. Each is a plus that contributes to overall *working* satisfaction from beginning to end use.

Specifically, B&W Carbon Steel Seamless Tubing is available in sizes up to 9⅝ inches outside diameter and B&W Welded is available in sizes up to 4 inches outside diameter. Both in a wide range of wall thicknesses.

As for finishes, seamless is produced either hot-finished or cold-drawn and welded is produced from either hot- or cold-rolled strip.

It meets the applicable specifications of the ASTM, ASME and Government as well as many specifications that may be required for an extraordinary end use.

Where and whenever Seamless or Welded Carbon Pressure Tubing is indicated, make use of B&W's many years in the manufacture of all kinds of tubing. Make *use* of B&W Carbon Steel Pressure Tubing.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

For the complete Carbon Steel Pressure story, write for B&W Bulletin TDC-142.

TA-4062(CP)

For more data circle 525 on Post Card

When you need instrument service . . .

Ever have a tire blow out while you're traveling late at night? If it happens near a service station, you're lucky. But if it's on a lonely road far from town, you've got trouble.

When it comes to service on instruments, you don't need to take chances on being lucky. Because when you have Honeywell instruments, you've always got the comfortable feeling that service is close at hand . . . whenever and wherever you want it . . . from the world's biggest instrument service organization.

OVER 110 SERVICE CENTERS

No matter where you may be, there's a Honeywell service man near you. Offices are located in more than 110 cities of the United States and Canada, near every large production center.

When you run into trouble, just telephone or wire the nearest of these offices. You'll get a service specialist promptly . . . often within a few hours. This quick attention to your needs protects your production schedules, and prevents delays that can cause costly stoppages.

TRAINED PERSONNEL

Honeywell service men are thoroughly trained for their important responsibilities. In the Honeywell factories, hand-picked men learn both the theory and practice of instrument maintenance. Then they serve an apprenticeship in the field offices, to gain further first-hand experience. You can be sure that the Honeywell man who calls at your plant is a qualified specialist, well versed in the practical art of keeping good instruments in the best condition.

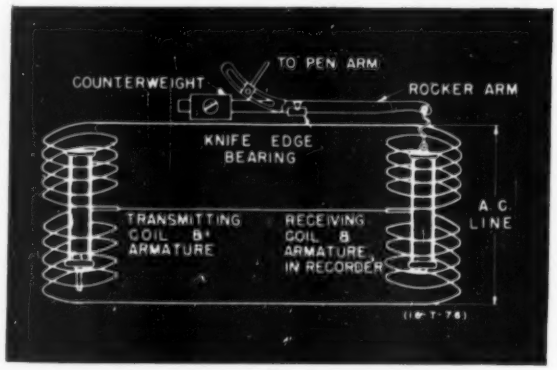
PERIODIC SERVICE

But why wait for emergencies—when you can prevent them with periodic service. Under a simple contract, a Honeywell man will visit your plant at regular intervals to inspect, clean and adjust your instruments and controls. The plan is economical, and can save you hours of production time. Our nearby office will be glad to give full details on Honeywell Periodic Service.

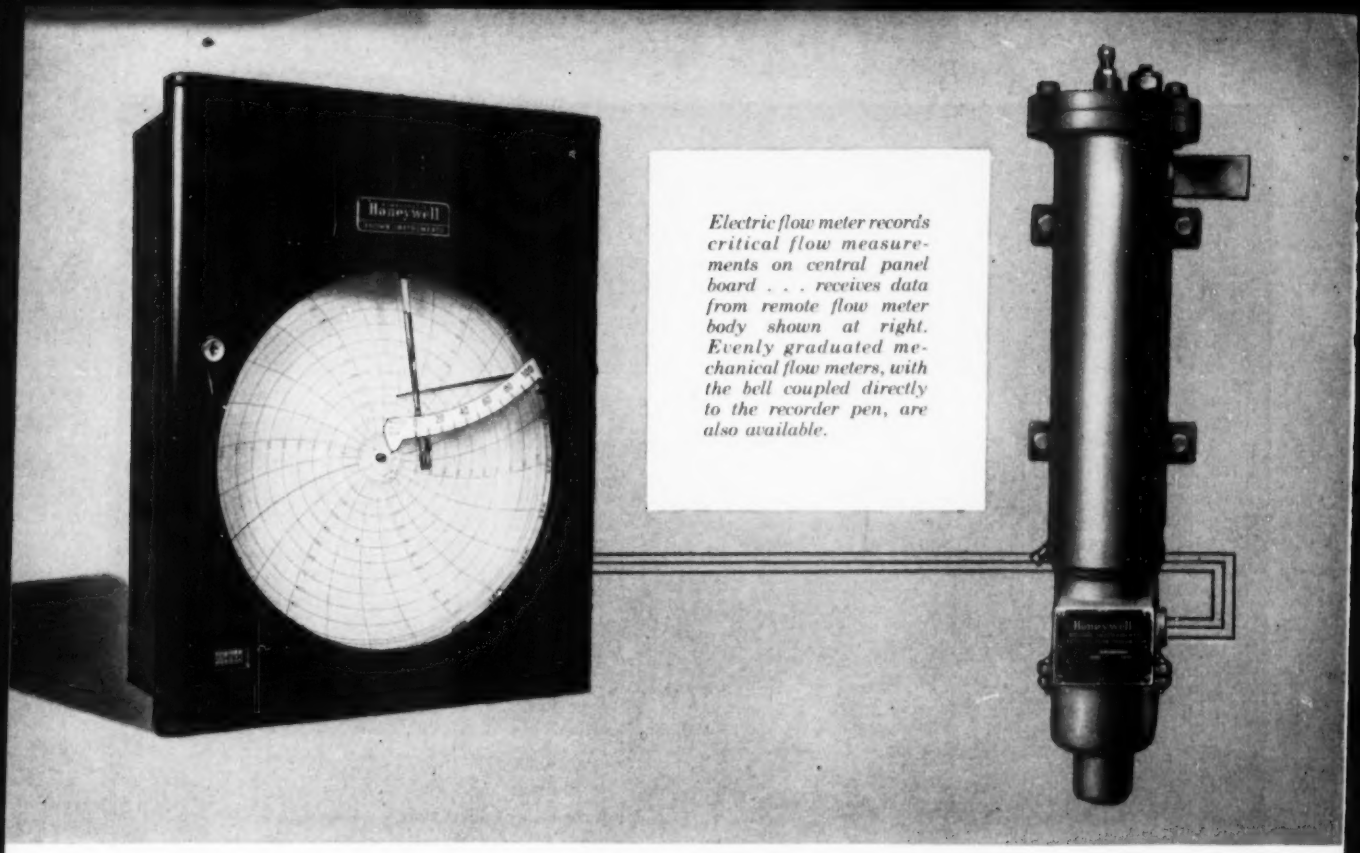
Better accuracy...

greater simplicity

.....for steam



ELECTRICAL TRANSMISSION SYSTEM *brings flow data instantaneously and accurately from the remote meter body to the Brown Flow Meter. The inductance bridge system consists of a transmitting coil and armature at the meter body, and an identical coil and armature in the instrument. The receiving armature faithfully duplicates the movement of the transmitter.*



Electric flow meter records critical flow measurements on central panel board . . . receives data from remote flow meter body shown at right. Evenly graduated mechanical flow meters, with the bell coupled directly to the recorder pen, are also available.

plant flow measurements

WHEREVER your steam plant uses measurement of flow . . . for steam, feedwater, make-up water or oil . . . Brown Electric Flow Meters offer every performance feature you could require. Compare these advantages:

Electronic integration . . . using high-speed, high-sensitivity electronic scanning . . . provides exceptional precision in totalizing flow. This unique integrator completely eliminates friction loading of the recording system. It's extremely simple; has only three major parts, and can be calibrated in only a few minutes.

Electrical transmission . . . ideal for centralized control . . . permits the meter body and instrument to be located hundreds of feet apart without loss of sensitivity. A precision-made inductance bridge transmission system (illustrated on the opposite page) gives faithful reproduction of remote measurements, and eliminates the problems of panel pipe connections.

Evenly divided chart assures easy readability and high accuracy at all flow values . . . no crowding of divisions at the low end of the scale.

Brown Electric Flow Meters are available in both square root and evenly graduated type meters with ranges applicable to practically all steam, water and oil measurements. Your nearby Honeywell sales engineer will welcome the opportunity to discuss your specific needs . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for new Catalog 2320, "Flow Meters, Indicating, Recording, Controlling."**

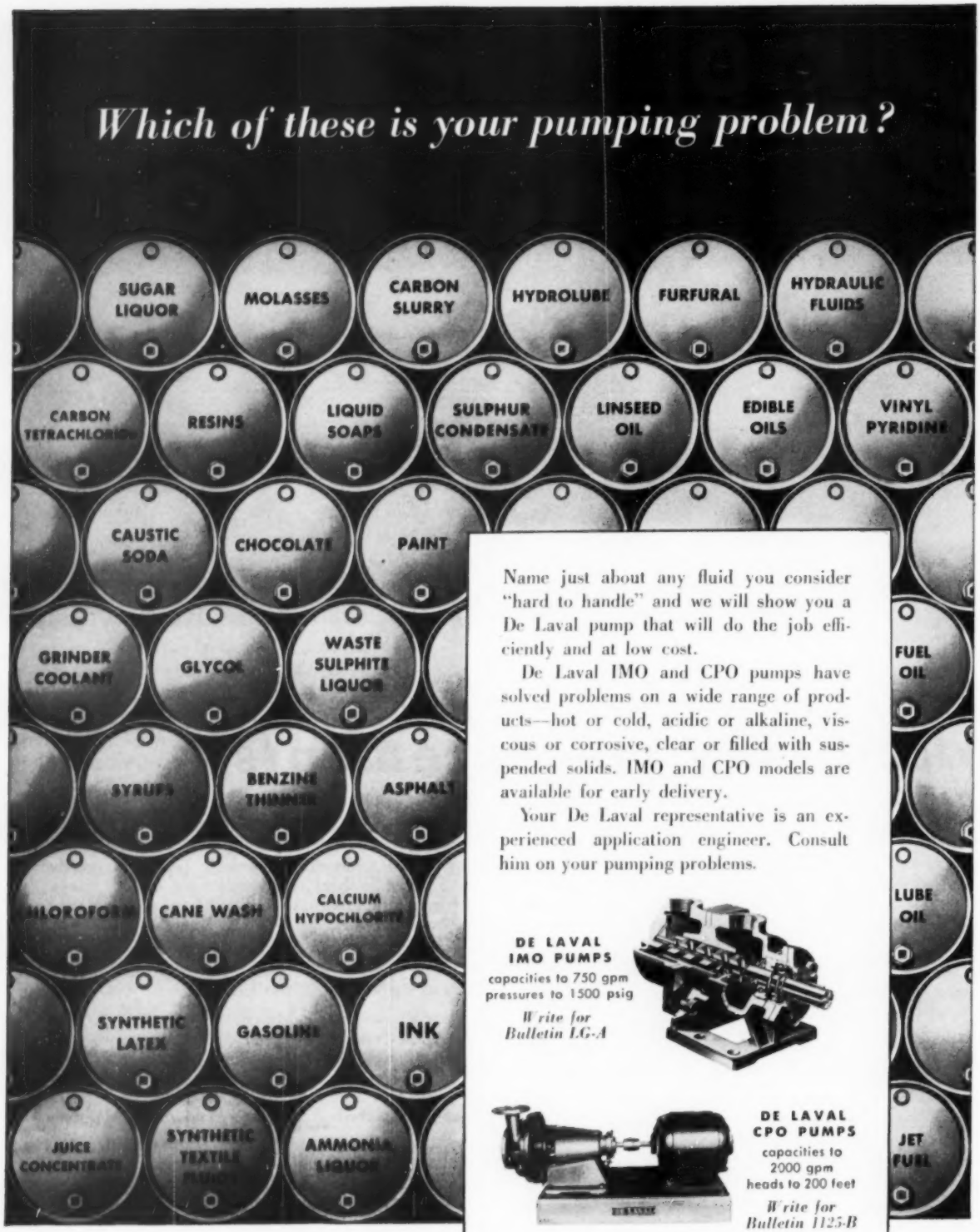
MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

For more data circle 526 on Post Card

Which of these is your pumping problem?



Name just about any fluid you consider "hard to handle" and we will show you a De Laval pump that will do the job efficiently and at low cost.

De Laval IMO and CPO pumps have solved problems on a wide range of products—hot or cold, acidic or alkaline, viscous or corrosive, clear or filled with suspended solids. IMO and CPO models are available for early delivery.

Your De Laval representative is an experienced application engineer. Consult him on your pumping problems.

DE LAVAL IMO PUMPS
capacities to 750 gpm
pressures to 1500 psig
Write for Bulletin LG-A

DE LAVAL CPO PUMPS
capacities to 2000 gpm
heads to 200 feet
Write for Bulletin 1125-B

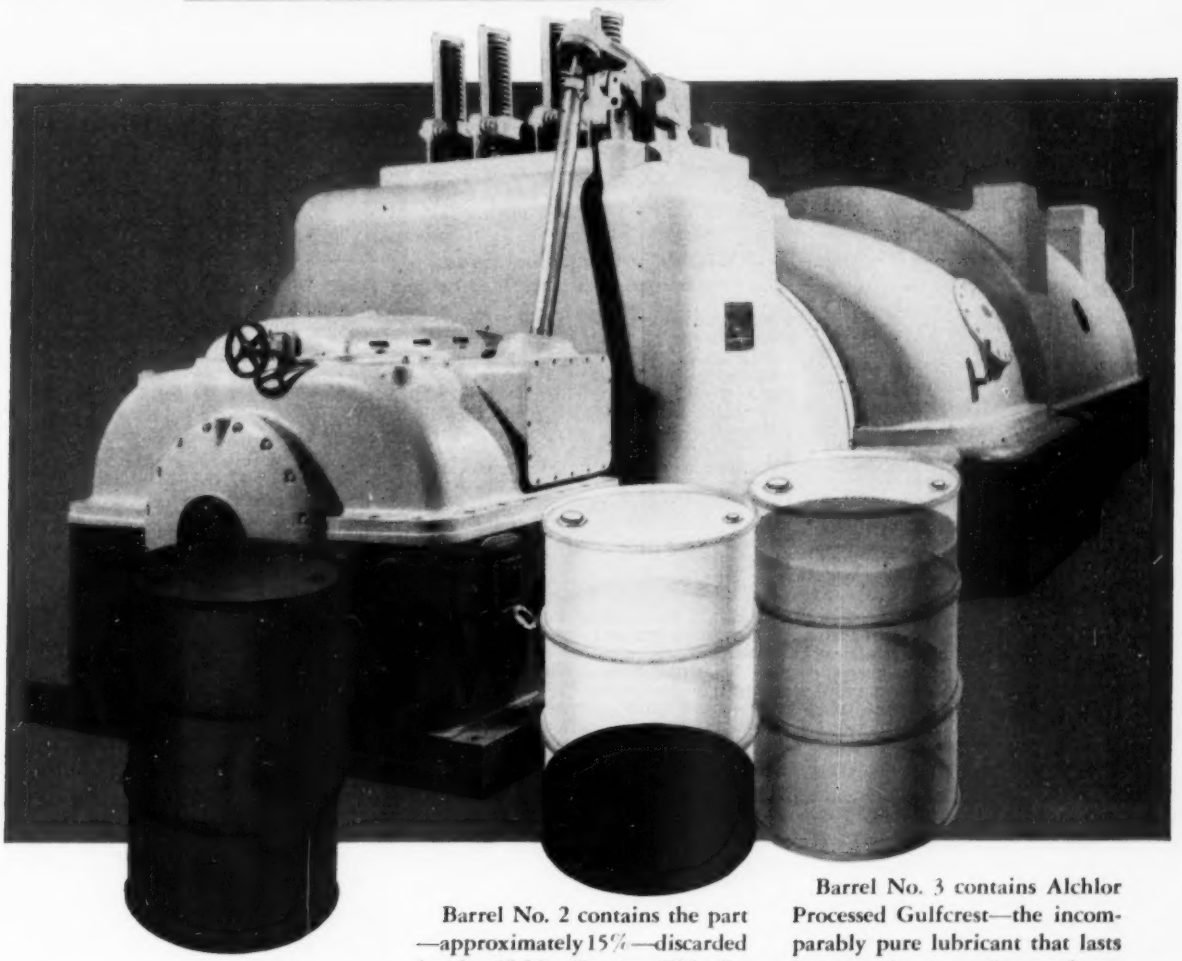
DE LAVAL *Pumps*

DE LAVAL STEAM TURBINE COMPANY
816 Nottingham Way, Trenton 2, New Jersey

DL 236A

For more data circle 527 on Post Card

GULFCREST *is the only turbine oil that is super refined for superior performance by the* ALCHLOR PROCESS



Barrel No. 1 contains a highly refined oil that will become Gulfcrest. It has gone through the usual steps used in refining other turbine oils—but has not yet been Alchlor Processed.

Barrel No. 2 contains the part —approximately 15% —discarded by the Alchlor Process. This discarded portion contains unstable hydrocarbons which, if allowed to remain in a turbine oil, are likely to oxidize, increase neutralization number, form sludge, emulsifiers, and harmful acids.

Barrel No. 3 contains Alchlor Processed Gulfcrest—the incomparably pure lubricant that lasts longer, gives superior performance and helps keep your turbine systems clean indefinitely. To make Gulfcrest even finer, special inhibitors are added to give it still greater stability and protect against corrosion and foam.

Call your nearest Gulf office today and have a Gulf Sales Engineer recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION • GULF REFINING COMPANY • 1822 Gulf Building, Pittsburgh 30, Pa.

For more data circle 528 on Post Card

EQUIPMENT NEWS

Described here are new and newly improved products. Use the Reader Service Cards on page 113 to ask for more information on them. Just circle item numbers of all the products in which you are interested.

1—PNEUMATIC TRANSMITTER for power plant instrumentation

Pneumatic telemetering and control systems may be simplified by the use of a new universal transmitting unit available for measurements of flow, level, pressure, temperature, draft, differential and vacuum. The measuring element actuates the transmitter's micro-sensitive van, nozzle and booster assembly. Transmitted signals of 3–15 and 3–27 psig may actuate pneumatic receivers and/or controllers. Both measured variable and pneumatic signal are indicated on a common scale.

The unit is about 8 in. by 10 by 3½ in. in size and its casing is said to be weather-, vibration-, and corrosion-resistant. Transmitting distance can be 1000 ft to receivers, 400 ft to controllers. Accuracy is given as within ± ½ per cent of measured range span; air consumption is reported to be less than 0.15 cfm. Bailey Meter Co.

2—LINE TRAPS designed to cover 400, 800-amp ratings

Type M line traps, originally designed for 1200-amp continuous-current operation, have been extended to cover 400- and 800-amp ratings. The molded design is planned to provide a lightweight trap capable of withstanding mechanical forces during faults, and reduce over-all trap size to a minimum. Tuning units available permit tuning to standardized channels in the 30- to 200-kc range without removing the units. Westinghouse Electric Corp.

4—MOTORS, totally-enclosed, explosion-proof, 150 hp

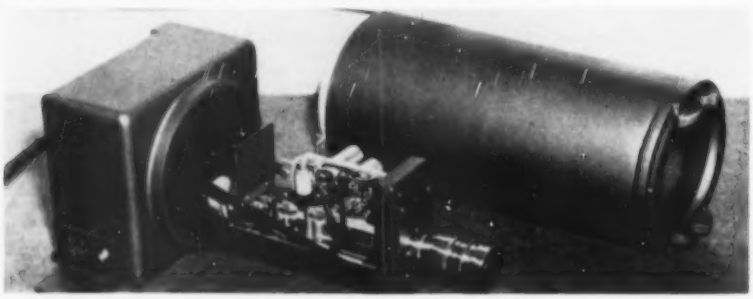
Maximum ratings of this manufacturer's horizontal totally-enclosed and explosion-proof motors have been increased to 150 hp. Type SD, the totally-enclosed motor, is designed for protection against dirt, moisture, oil and chemicals; Type SE, explosion-proof, for service where inflammable gases, volatile liquids or combustible dusts may be present. The latter is supplied with U.L. label for Class I — Group D, and Class II — Groups F and G. Both motors are double-enclosed with a built-in fan. They have asbestos-protected windings; removable stator cover plate; solid, dynamically balanced, cast aluminum rotor; and Lubriflush bearings for re-lubrication without disassembly.

Available from ⅓ to 150 hp, they may be supplied in combination with company's Varidrives when variable speeds are desired, or Syncrogears when geared multiplied torque is needed. A bulletin contains further information. U. S. Electrical Motors Inc.

3—CONDULET HOUSING for TV camera used in hazardous locations

For use in hazardous areas as an operations monitor, this RCA television camera is shielded by an explosion-proof cast aluminum condulet housing, it is announced. The compact camera is designed to accommodate any standard mm Type C mount lens. Its Vidicon tube is 6½ in. long and ½-in. diam, with provision for compressed air cooling to limit its operating temperatures.

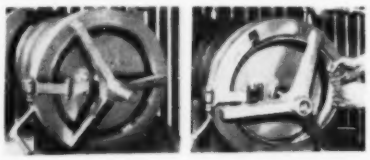
The housing is designed to meet U.L. requirements for Class 1, Group D locations where presence of volatile and inflammable solvents may cause explosion, and Class II locations, where combustible dusts may cause flash fires. Threaded housing joints allow entry of gas vapors into the housing, and once these vapors contact an electrical arc they explode, it is explained; however, the cooling of the explosion fumes in passing through the joints as exhaust gases allow safe operation. The housing is 8½ in. wide, 10 in. high, 22¾ in. long, and has a barrel diam of 7¾ in. Crouse-Hinds Co.



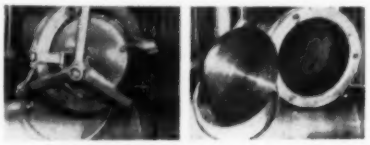
5—CLOSURE for pressure vessels and piping systems

The Flex Ring Closure incorporates an internal pressure closing, metal-to-metal seal principle — it seals tighter as pressure on it increases. This closure is said to require less opening and closing time, and is described as having fewer parts than many seals and being lighter in weight. It consists of weld neck, plug, spider and metal gasket held in compression between plug and weld neck.

To assemble, the gasket is flexed so it can pass through the plug opening, and the spider nut tightened to cause the gasket to return to a round shape for proper seating position. The equally simple disassembly procedure is illustrated



in these photos which show the unit assembled as in service, above left, and the spider released and gasket being removed. Below, at left, the gasket has



been removed and the plug rotated to open. The last photo shows it open.

Flex Ring Closures are available in same pressure ratings as ASA flanges, have same pressure and temperature rating as corresponding ASA raised face flange, and are adaptable to special designs and materials. Bulletin 3000 provides data. Sillers Engineering Co.

6—CORROSION INHIBITOR for quicker, longer protection

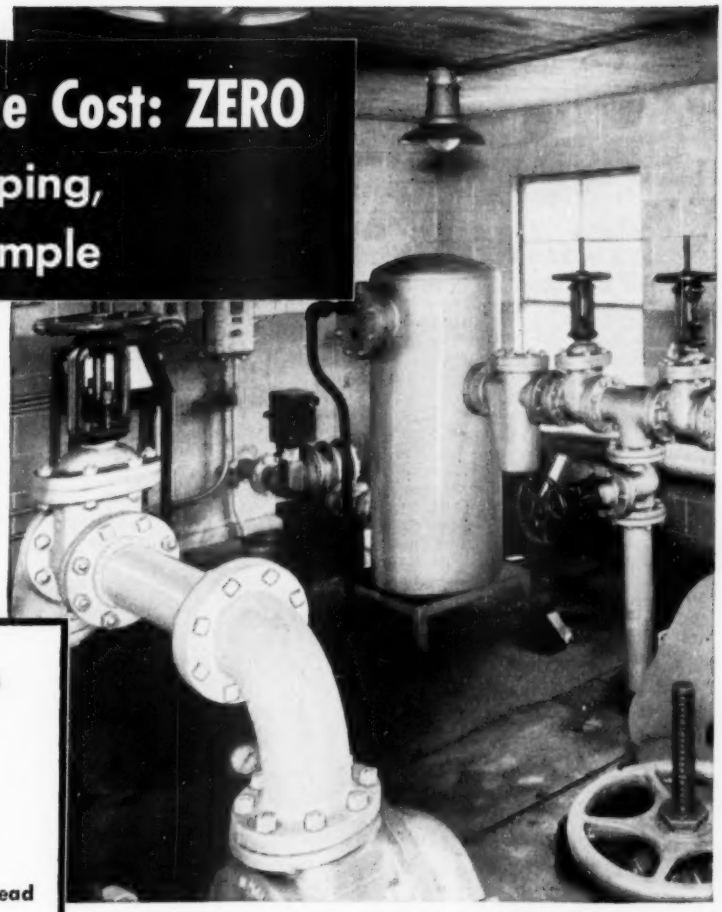
Portions of this crystalline amine nitrite compound volatilize rapidly to prevent rust almost immediately, it is explained, while other constituents evaporate more slowly for longer lasting protection. The

new material, VPI 250, is also said to flow more freely than previous inhibitors. It is a fine white powder which can be applied with squeeze bottle or salt shaker. Where spraying or dusting is impractical, the powder may be dissolved in alcohol and applied in solution.

Several corrosion fighting features are announced for VPI-250. It doesn't require direct application to the surfaces it protects — if the powder is dropped into an enclosed space, its vapors penetrate hard-to-reach areas and condense on all surfaces. And the crystalline

Valve Maintenance Cost: ZERO

...on fuel oil piping, for example



The Installation

At North End Yard, The Cincinnati Union Terminal Railroad, using Crane steel valves and fittings throughout diesel fuel receiving and filling system. Working pressure, 40 pounds.

Valve Service Ratings

SUITABILITY:
Doing the job as intended

FEATURES:
Exelloy seating

MAINTENANCE COST:
Zero

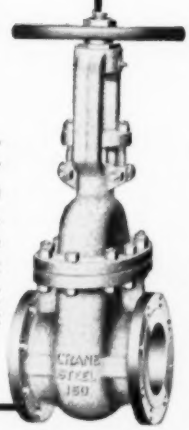
SERVICE LIFE:
Installed 1948—Shows long life ahead

OPERATING RESULTS:
Low-cost, trouble-free fueling

AVAILABILITY:
Crane catalog item—No. 47X

The Valve

150-Pound Steel Gate—with its exceptional performance assured by Crane quality design . . . by Crane pioneering skill in steel casting . . . and the high adaptability of Crane Exelloy trim for oil services. Sizes 2 to 24 in.; screwed, flanged, or welding ends. See your Crane Catalog, or ask your Crane Representative.



The Case History

Not until the terminal's engineers were convinced of its dependability and low-cost maintenance was any equipment bought for this project. Many similar systems were studied for the best means of assuring utmost economy of operation. The installation was made in 1948 . . . with welded piping where practical, using Crane materials exclusively—steel fittings, check valves, and No. 47X, 150-Pound steel gate valves.

More than 5 years later the terminal reports: Piping system operation entirely satisfactory; maintenance cost to date: zero. Further result: Crane valves have earned top consideration for proposed extension of system. The terminal knows the value of thrifty buying—quality always outweighs price-tag savings.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 529 on Post Card

film of VPI-250 does not have to be removed from equipment before placing it in operation. Also, only small quantities are needed for protection in shipment or storage. Small items, such as tools, can be removed from a protected atmosphere, used, and then replaced without need for other rust-preventive measures. Shell Oil Co.

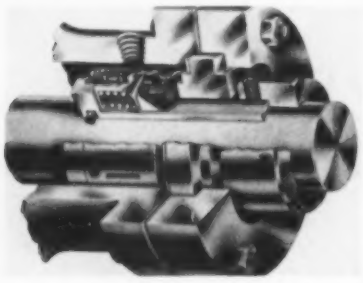
7—VOLTAGE REGULATOR for 25 to 250 kva generators

Universal Model JSG 1/1 is announced as a highly sensitive, generator voltage regulator, which, by jumpering at the external terminals on the back of the unit, is ready to regulate any 25 to 250 kva generator (50 or 60 cycles, 1200 to 1800 rpm with a rated exciter voltage of 80 to 125 v). Manufacturer says regulator carries a sensitivity of 1.5 per cent.

Voltage regulation is provided by company's rocking contact and a commutator type contact track, consisting of 50 heavily silver-plated contact segments wrapped in multiple layers of mica sheet in a bronze frame. For shock and vibration resistance, two pairs of floating sapphire jewel bearings are used to support the main and auxiliary shafts. Jumper arrangements for application under various operating conditions are available. Brown Boveri Corp.

8—MECHANICAL SHAFT SEAL for split case pumps

The John Crane Type 9 Mechanical Shaft Seal is mounted on a sleeve with an outside clamping ring for quick installation or removal on split case pumps, company says. It is not necessary



to unbolt the top of the horizontal split shell in the event of seal failure. You merely remove the old seal and replace with new. The seal is designed to handle practically all corrosive liquids at temperatures to 500 F. Flexible sealing members are made of Teflon, springs and metal parts can be furnished according to service requirements. Sizes are available to specifications. Crane Packing Co.

9—INDUSTRIAL WIPERS, of soft, non-woven material

Downy Soft Wipers are made of lightweight disposable, non-woven fabric. According to manufacturer, this material is durable, highly absorbent, and lintless — strong enough to be rinsed and re-used, but inexpensive enough to be discarded when soiled. A feature of the product is that it is shipped in cartons of only 25 lb, loosely packed so it retains the downy soft finish. In quantity purchases, the wipers are reported to cost about 1 cent each for an 18-by-36 in. size. The Leshner Corp.

10—MOLDED PIPE INSULATION now available in more sizes

Hot and cold piping from ¾ to 24 in. in diameter can now be covered with G-B Snap On Pipe Insulation. A one-piece molded pipe insulation of fine glass fibers, this product was introduced last year in a limited number of sizes. It is intended for insulating chilled and refrigerated lines and heated lines where temperatures do not exceed 350 F. Because it nests with other insulations, it is also used as a second layer on high temperature lines. It is now made available in 3- and 6-ft lengths, depending on pipe size — pipe sizes up to 2 in. will be in 3-ft lengths. Wall thicknesses of ½, ¾, 1 and 1½ in. are available in sizes to 12-in. pipe size; and thicknesses of 1, 1½ and 3 in. for piping above 12-in. diam.

It is pointed out that for any insulating job, G-B Snap On costs no more than other pipe insulating materials, and it offers worthwhile savings in application costs. The user simply

spreads it open at the single seam and snaps it over the pipe. The seam is joined with staples or other means, and the material painted, left "as is" or finished as desired. This lightweight insulation is also available with a factory applied vapor-barrier for use on cold piping and with a weatherproof roofing paper for outside pipe lines. Gustin-Bacon Mfg. Co.

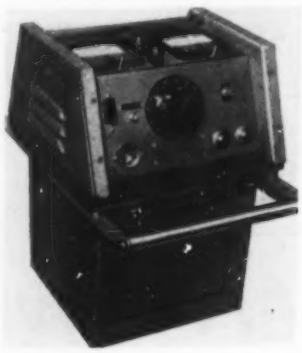
11—SALT SPLITTER uses basic anion exchange resin

For small and medium sized plants, the Dealkalizer uses a strongly basic anion exchange resin capable of salt splitting and substituting chloride anions, for bicarbonate, carbonate, sulphate and nitrate radicals. It is claimed this process of chloride anion exchange reduces alkalinity without use of acids, reduces CO_2 in steam, and provides continuous treatment under pressure. Company says that together with their Zeo-Flo Softener, the unit is designed to provide custom-engineered systems at practically stock costs. Cochrane Corp.

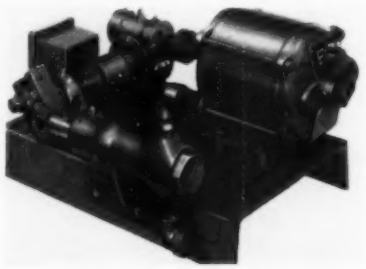
12—DIELECTRIC TEST SET for d-c voltages up to 40 kv

Developed in response to a growing use of higher d-c test voltages, this portable instrument measures direct current at voltages up to 40 kv when applied to the insulation of generators, transformers, bushings and cable. Among advantages claimed for it are safety features, good output voltage regulation, simple operation, compact design, and facilities for measurements at either polarity.

The set has a current rating of 25 ma at short circuit, and current measure-



ments can be made down to 0.5 mu, the first division on the microammeter. High voltage components are oil immersed. The set weighs about 120 lb. Bulletin 22-25 describes it. James G. Biddle Co.



13—CONTROLLED VOLUME PUMP for proportional feed system

In this motor-driven controlled volume pump, a mechanical, single revolution clutch arrangement permits one stroke of the pump in response to an electrical signal to effect feed of an additive in proportion to main line flow rate. This signal may be transmitted by a timer and electrical contacts on a positive displacement meter. The pump has capacities from 1 pt to 1350 gal per hour, against discharge pressures to 50,000 psi. Milton Roy Co.

14—MOTOR STARTERS for hazardous areas, corrosive service

This line of Class I Group D motor starters is announced as especially suited to refinery, pipe line, paper mill, chemical processing, and similar applications. For protection against explosion, all connections, terminals, arcing parts and main line disconnect switches are oil-immersed, says manufacturer, and oil immersion also keeps the mechanism lubricated and protected.

The starters are of company's Valimiter (volt-ampere-limitor) type, designed for over-all short circuit protection for 2200-5000 v motors, irrespective of the magnitude of the fault or of the available capacity. They limit maximum possible fault current to 25,000 kva interrupting capacity, it is pointed out, and the magnetic contactors used have more than ample capacity to clear faults of this magnitude. They are rated at 50,000 kva interrupting capacity, and said to be adaptable to a wide range of motor sizes without change. Manu-

Another great Detroit Stoker.....

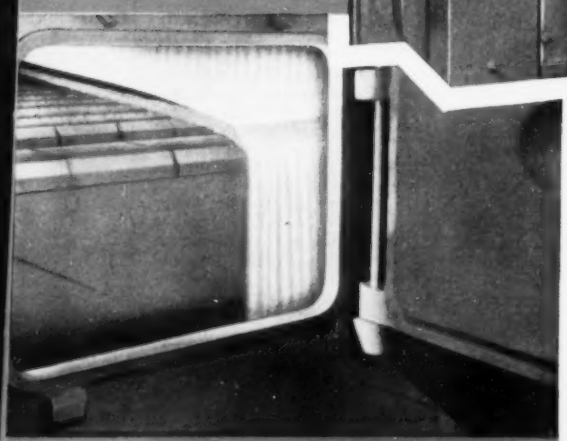
MOST IMPORTANT DEVELOPMENT IN COAL BURNING SINCE INTRODUCTION OF THE DETROIT ROTOGRATE

Detroit RotoStoker Type C-C

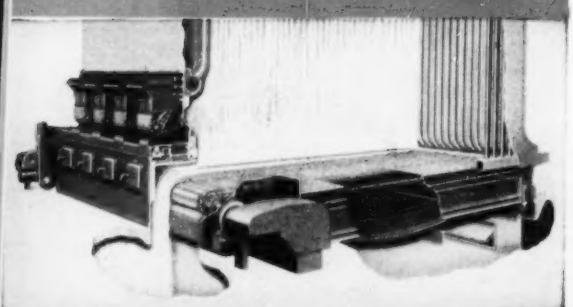
(CONTINUOUS CLEANING)

Detroit RotoStoker Type C-C discharges ash continuously at the front.

Detroit RotoStoker Type C-C (Continuous Cleaning)



Detroit RotoGrate Stoker—Traveling Grate Spreader Stoker



Users of medium and small size steam generators may now have the long proven advantages of continuous ash discharge spreader stoker firing with the Detroit RotoStoker Type C-C.

CHECK THESE ADVANTAGES:

- **Cleans Fuel Bed and Discharges Ash Continuously at the front.**
- **Smokeless Operation Through a Wide Load Range**
- **Efficiently Burns Bituminous Coals and Lignite.**
- **Insures Continuous Uninterrupted Steaming Capacity and High Availability.**
- **Responds quickly to Fluctuating Loads**
- **Fuel Feeders Handle High Moisture Coals Easily and Without Clogging**
- **Operation Automatic and Dependable**
- **Easily Applied to Existing Boilers—No Basement Necessary**
- **Design results in Low Maintenance**
- **Many Sizes Available to Develop from Approximately 5,000 to 75,000 Pounds of Steam Per Hour**

For large steam generators Detroit RotoGrate Stokers have proven their merit for more than fifteen years. The *first* and *foremost* traveling grate spreader stoker, the Detroit RotoGrate Stoker was first to establish the tremendous advantages of continuous ash discharge, spreader stoker firing.

DETROIT STOKER COMPANY

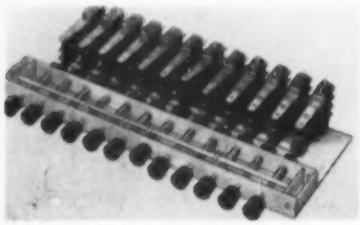
GENERAL MOTORS BLDG., DETROIT 2, MICH.

Works at Monroe, Mich. • District Offices in Principal Cities

facturer adds that they are suitable for use with high inrush motors, and their thermal capacity is such that they can withstand frequent starting. The Electric Controller & Mfg. Co.

15—PUSH BUTTON SWITCHES redesigned for longer life

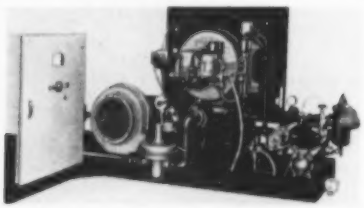
The Model MPB Switch consists of an extruded sturdy frame on which are mounted push button units of from two to 12 positions. The following types are offered: Accumulative Lock; No Two Interlock; Lock Release, and Non-Lock.



The MPB Switch is said to be smaller, more rugged and shock resistant than company's previous heavy duty push-button switches. Other advantages announced are longer life, improved appearance, and easier operation, mounting and assembly. Ratings and mounting dimensions of previous model have been retained. General Control Co.

16—BURNER UNITS for gas, oil, and gas-oil combination firing

For commercial-industrial heating and power applications, this new series of packaged burners includes seven stock sizes. Gas burners range from 3,750,000 to 24,000,000 Btu input; oil burners, from 25 to 145 gph. Each unit has an enclosed electrical control panel and a



forced draft fan which will deliver necessary air against a positive furnace pressure. This pressure enables Scotch marine and other boilers which may be fired with a pressure in the firebox to be operated without stacks, it is explained, only vent pipes to the outside being needed.

Combination gas-oil models are designed for quick changeover. These and the straight gas-fired units include a low pressure ring-type gas burner, automatic gas controls, air volume control and electronic combustion control system. Oil burners, rotary cup type, are available for all grades of fuel oil. Petro.

17—HAND TACHOMETER incorporates scale-changing device

A portable, hand tachometer with scale-changing device which reduces misreading of its various ranges is announced as offering accuracy of ± 1 per cent of full scale under all conditions. Three models, each having three ranges, measure rotational speeds from 2 to 100,000 rpm and linear speeds from 2 to 10,000 fpm with accessories. Applications of the tachometer include speed measurement of motors, generators, turbines, all continuous webs.

The equipment consists of two basic units: a head, which is placed against the moving object; and an indicator, attached by a 2-ft flexible electric cable. The head unit includes a rotating shaft which operates a set of contacts through a positive cam mechanism. It weighs only 6 oz, can be placed in contact with moving objects in limited space.

The indicating unit incorporates a reactance circuit, multi-scale milliammeter, and a flashlight-cell power supply. Accessories include one internal and two external cone tips, 0.1-ft and 1-ft disks, low-speed and high-speed adapters, all in a carrying case with the tachometer. General Electric Co.

18—CUTTER snips BX armored cable in one stroke

The Armor Cutter for BX armored cable is designed to snip both sides of the armor in one stroke, without touching the wire conductors inside. It is claimed the cutter replaces hacksaw cutting, is easy

to use in tight locations, and adjusts to all common BX cable sizes. Handles and jaws are drop forged and precision machined, with removable cutting blades. The cutter is 10 in. long. Telkor, Inc.

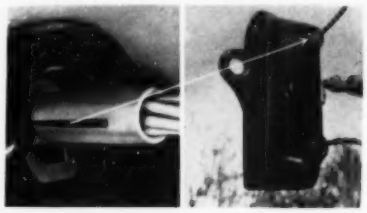
19—CENTRIFUGAL PUMP is designed for leak-proof service

The new Chempump, a seal-less centrifugal pump, is announced as leak-proof, and having a welded construction that allows field dismantling and reassembly. Manufacturer reports the new model is being used on applications ranging from butyl-acetate to titanium tetrachloride, and include pumping hard-to-handle fluids such as hot sulfite liquor, without fluid contamination. Chempump Corp.

20—CONNECTOR joins aluminum cable to electrical equipment

Interchangeable use of aluminum and copper electrical conductor in switch and control equipment is possible with this connecting device, says its developer. Called an aluminum cable adapter, it's expected to solve a major problem in distribution circuits, especially since price advantages and availability suggest aluminum as an electrical conductor in many applications. The adapter comes in straight and right angle types for No. 4 and 2 stranded aluminum cable.

Made from a tin-plated copper alloy, this adapter is designed to combine good electrical conductivity with springiness. It has a round barrel from which extends a smaller, split cylinder called a tang. The barrel fits on the cable and the tang is inserted under the equipment clamp. The slot that splits the tang extends into the barrel, forming two legs. When clamped, these are squeezed together like cantilever springs. This spring pressure is effective all around the cable



surface, it is noted, and compensates for any expansion and contraction.

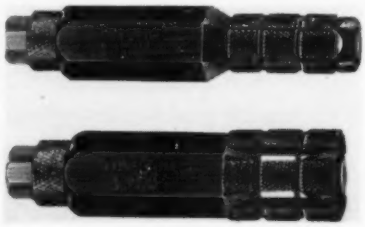
It is explained that since the oxide film forming on aluminum has high electrical resistance, cleaning action is built into this connector. And a factory-applied oxide-inhibiting compound seals the joint from air and moisture. Its copper-alloy construction serves to protect the ductile aluminum cable from mechanical damage by electrical equipment clamps; while its heavy coat of tin plate resists galvanic corrosion.

The adapter is installed by driving it on the cable with a hammer or other tool. Then the adapter cable assembly is inserted under the equipment clamp. As the clamping screw squeezes the adapter's legs together, the serrated bore takes a firmer grip on the cable. The Thomas & Betts Co.

21—TUBE AND PIPE WRENCH is internal expanding unit

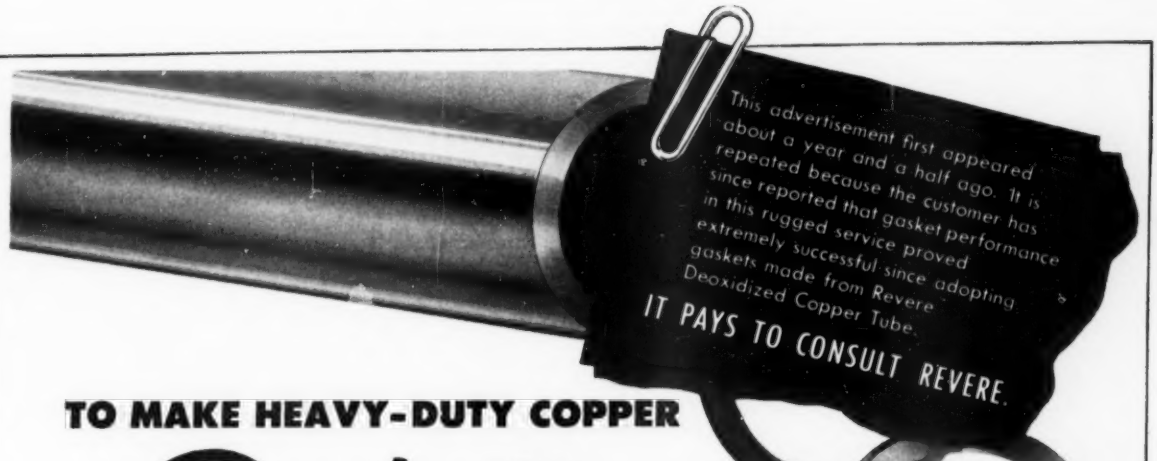
When expanded in a pipe or tube of any material, Tube Tule exerts a gentle but positive internal grip, says manufacturer, and there is no slippage no matter what kind of wrenching device applies the external pressure. Tube Tule is claimed not to distort the wall of the pipe or tubing because it "fits fully around" inside and the applied pressure is equal in all directions wherever it comes into contact with the internal wall. An important feature announced for Tube Tule is that while it grips positively, when handled properly it does not bite out or shred the piping.

The internal expanding section of Tube Tule is composed of six equal round-surfaced sections, which expand uniformly by forced movement up the



beveled section of the head when hand or wrench pressure is applied. In many instances, the internal expanding surface may be brought into a positive grip with the inside by turning the knurled hand knob and then applying additional pressure with a wrench.

Tube Tule comes in three sizes with internal expansion of $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. The smallest of these sizes lists for less than $8.00. Double T Products Co.



This advertisement first appeared about a year and a half ago. It is repeated because the customer has since reported that gasket performance in this rugged service proved extremely successful since adopting gaskets made from Revere Deoxidized Copper Tube.

IT PAYS TO CONSULT REVERE.

TO MAKE HEAVY-DUTY COPPER

Gaskets

USE REVERE DEOXIDIZED

Tube!

Diesel Fuel Injection Pump, made by American Bosch Corp., Springfield, Mass., and gaskets made by cutting rings off 2" deoxidized copper tube.

• An important extra service rendered by Revere consists of collaboration in setting up specifications. This is valuable because there are many different Revere Metals, each with special characteristics. No one copper, for example, will serve to best advantage in every application. A case in point is the matter of copper gaskets for Diesel fuel injection pumps. Copper is of course an ideal metal for gaskets, and is widely used for that purpose. But for this special application, which copper and in what form? The pump is used on large engines for municipal generating plants. It weighs 186 pounds, and must produce the high pressure required to inject fuel near the top of the Diesel compression stroke. Naturally, the load is a pulsating one. American Bosch Corporation came to Revere with the problem. Our suggestion was that much scrap could be saved if the gaskets were made by cutting rings off copper tube, instead of stamping them from strip. This achieved a double purpose, since the tube is made of deoxidized copper, which is superior in this application to electrolytic. We are able to report that these recommendations proved successful.... This work was done by the Revere Technical Advisory Service. To get in touch with it, see the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

For more data circle 531 on Post Card

CONSTRUCTION NEWS

Bessemer City, N. C. — Lithium Corp. of America, Inc., Rand Tower Bldg., Minneapolis, Minn., plans power house at new lithium mining and refining plant at Bessemer City, where site has been selected. Entire project reported to cost about $7,000,000. Work will begin soon. Norman C. Nagle, 725 Vineland Pl., Minneapolis, is architect.

Hartford, Conn. — Connecticut Light & Power Co., 36 Pearl St., has arranged for sale of block of preferred stock totaling $10,000,000, proceeds to be used for expansion and improvements in power plants, power substations and other properties. As noted recently in these columns, company will make extensions in Rocky River steam-electric generating station, New Milford, Conn., to cost over $7,500,000, for which United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa., is engineer and contractor.

Gainesville, Fla. — Sperry Corp., Electronic Tube Div., 30 Rockefeller Plaza, New York, N. Y., electronic tubes for military air navigation and other service, plans boiler house at new branch plant at Gainesville, where site has been selected. Factory will total about 60,000 sq ft floor space and is estimated to cost approximately $600,000. Work will proceed at early date.

St. Petersburg, Fla. — Florida Power Corp., 101 South Fifth St., has arranged financing in amount of $7,500,000, through sale of preferred stock, of which about $4,000,000, will be used for construction, including generating stations, power substations, transmission lines and other operating facilities.

Danville, Ill. — General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y., plans steam power house at new plant at Danville, for production of refrigerants and aerosol specialties. It will comprise several one and multi-story buildings for processing and general manufacture. Entire project is reported to cost over $2,000,000. Proposed to have plant ready for operation early in 1955.

Springfield, Ill. — Central Illinois Public Service Co., has arranged for sale of bond issue of $5,000,000, proceeds to be used for extensions and improvements in power plants, power substations, transmission lines and other facilities.

Bancroft, Iowa — Town Council has approved plans for expansion and improvements in municipal electric power plant, including installation of a new Diesel engine-generator unit and auxiliary equipment. No estimate of cost announced. Stanley Engineering Co., Hershey Bldg., Muscatine, Iowa, is consulting engineer.

Coffeyville, Kan. — City Council has approved plans for expansion and improvements in municipal steam-electric generating station, with installation of new 15,000-kw turbine-generator unit and auxiliary equipment. No estimate of cost announced. Work will be carried out soon. Lutz & May, Finance Bldg., Kansas City, Mo., are consulting engineers.

Portland, Me. — Central Maine Power Co., 9 Greene St., Augusta, Me., has plans for new one and three-story building at Portland, for new service, shop, stock and general operations division, 60 x 120 ft and 130 x 140 ft, respectively. Cost about $1,000,000, with equipment. Proposed to begin work soon. Alonzo J. Harriman, 392 Court St., Auburn, Me., is architect.

Boston, Mass. — Boston Edison Co., 39 Boylston St., is arranging financing in amount of $18,000,000, through sale of bond issue, proceeds to be used for expansion and improvements in power plants and system, including increased generating capacity, power substations, transmission lines and other operating facilities. As recently reported in these columns, company is considering an expansion program at power plant at Everett, Mass.

Needham, Mass. — Farrington Mfg. Co., 76 Atherton St., Boston, Mass., covered metal jewel and display cases, plastic display boxes, etc., plans boiler house at new plant at Needham. It will be two-story, comprising about 350,000 sq ft floor space. Cost reported close to $3,000,000. Work will proceed at once.

Livonia, Mich. — Fisher Body Div., General Motors Corp., General Motors Bldg., Detroit, Mich., plans power plant at new automobile body works at Livonia. It will comprise a number of new buildings for production, with entire project reported to cost about $7,500,000. Argonaut Realty Div., General Motors Corp., General Motors Research Bldg., Detroit, is architect and engineer.

Las Vegas, Nev. — Southern Nevada Power Co., South Second St., plans new steam-electric generating station on local site, estimated to cost close to $600,000, with turbine-generator, high-pressure boilers and auxiliary equipment. Proposed to carry out program soon.

Asbury Park, N. J. — Jersey Central Power & Light Co., 501 Brand Ave., has disposed of a bond issue of $6,000,000, proceeds to be used for current construction program, including power plants, transmission lines, distribution lines, power substations and other work.

Mineola, L. I., N. Y. — Long Island Lighting Co., Old County Rd., has arranged an expansion and improvement program in plants and system during next 18 mos., to cost about $75,000,000, including increased generating facilities, power substations, transmission lines and other operating structures.

Correction: — June issue, page 56, column 2: Lorain, Ohio — The item concerning the new 90,000-kw generator unit, to be installed at the Edgewater steam-electric generating plant, should have stated that this was being done by Ohio Edison Co. and NOT by Ohio Public Service Co. Also, Ohio Edison Co. no longer has a Lorain Division — the proper name for that area is the Lake Erie Division. The Ohio Public Service Co. passed out of existence in 1950 when it was merged into Ohio Edison Co.

Johnstown, Pa. — Pennsylvania Electric Co., has arranged for a note issue of $3,000,000, fund to be used in connection with expansion and improvement program, including power plants, substations, transmission lines and other operating facilities.

Philadelphia, Pa. — Philadelphia Electric Co., 1000 Chestnut St., has disposed of a bond issue approximating $30,000,000, proceeds to be used for construction program, including expansion in generating facilities, power substations, transmission lines and other work.

Pickens, S. C. — Pickens Mill, Inc., sheetings and other cotton goods, plans boiler house at new mill on local site. It will approximate 50,000 sq ft floor space, and is reported to cost close to $1,000,000, with machinery and auxiliary equipment. Work is scheduled to be carried out in fall.

Houston, Texas — Wilson Oil Co., Cotton Exchange Bldg., plans power house at new oil refining plant on Katy Hy., where 25-acre tract of land has been selected. It will comprise several one and multi-story structures for refined oil and gasoline production. Cost estimated about $2,500,000. Proposed to begin work soon.

Salt Lake City, Utah — Utah Chemical Co., care of N. G. Morgan, Jr., Wasatch Oil Bldg., (oil operator), recently organized by Mr. Morgan and associates, plans power plant at new chemical works in Sanpete Valley district (Sanpete County) Utah, for production of anhydrous ammonia, nitric acid and kindred products. It will comprise a series of one and multi-story processing and manufacturing buildings, and is estimated to cost about $19,000,000. Project has been approved by Office of Defense Mobilization, Washington, D. C. Proposed to begin work soon.

Suffolk, Va. — Thomas J. Lipton, Inc., 1500 Hudson St., Hoboken, N. J., tea, soup and other food specialties, plans boiler house at new tea processing and bagging plant at Suffolk, where large tract of land has been acquired. It will consist of a main one-story structure and several smaller buildings for auxiliary service. Entire project is reported to cost close to $1,000,000. Work will be placed under way in near future.

Seattle, Wash. — Dept. of Lighting, Seattle, plans new power dam in Skagit River, to provide increased water supply to municipal hydroelectric generating station on Skagit River, Whatcom County. Generating station will be equipped for an increased output of 59,000 hp., to provide a total rating of 192,000 hp. Entire program is estimated to cost $15,000,000. Application for permission has been made to Federal Power Commission, Washington, D. C.

St. Marys, W. Va. — Linde Air Products Div., Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., plans power house at new plant at Long Reach, near St. Marys, for manufacture of silicones. It will consist of a number of one and multi-story buildings for processing and general production, with equipment and facilities for large output. Cost reported over $10,000,000. Work will be placed under way soon on building erection.

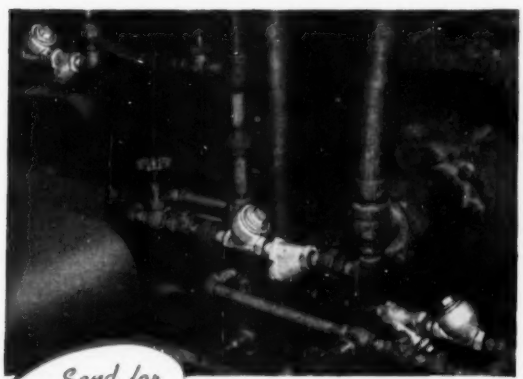
Prairie du Chien, Wis. — Wisconsin Power & Light Co., 122 West Washington St., Madison, Wis., plans new steam-electric generating station at Prairie du Chien, where site has been selected. Cost reported close to $20,000,000, with turbine-generators, high-pressure boilers and auxiliary equipment, including switchyard and transmission lines. Work is expected to begin in fall.

NICHOLSON TRAPS UP PRODUCTION at Certain-teed Plant

Above, Certain-teed Products Corporation's Dallas, Texas, roofing plant, where Nicholson steam traps have been adopted as standard.

Why this modern Dallas, Tex., plant of Certain-teed Products Corporation has standardized on Nicholson steam traps may be important to you. It was because, as a plant official stated, "Nicholson traps have cut loss of steam and improved operations generally". More specifically, a recent survey showed these Nicholson features to be the reasons why leading plants are increasingly standardizing on Nicholson thermostatic traps:

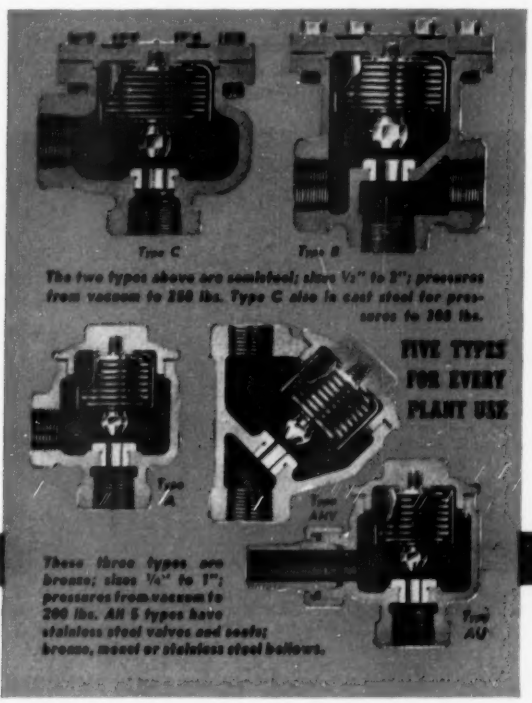
(1) Two to six times average drainage capacity. (2) Operate at lower temperature differential. (3) No air binding. (4) Freeze-proof. (5) Only one moving part. (6) No need to change valves for varying pressures. (7) Record low for steam waste. Types for every process, power and heat application.



Send for **CATALOG 953**

Contains installation diagrams and data for determining proper size of trap.

Nicholson traps on drying drums of asphalt saturator; Certain-teed's Dallas, Tex., plant.


Type C
Type B
The two types above are semisteel; sizes ½" to 2"; pressures from vacuum to 250 lbs. Type C also in cast steel for pressures to 300 lbs.
FIVE TYPES FOR EVERY PLANT USE
Type A
Type AMV
Type AU
These three types are bronze; sizes ¼" to 1"; pressures from vacuum to 200 lbs. All 5 types have stainless steel valves and seats; bronze, monel or stainless steel bellows.

W. H. NICHOLSON & CO.

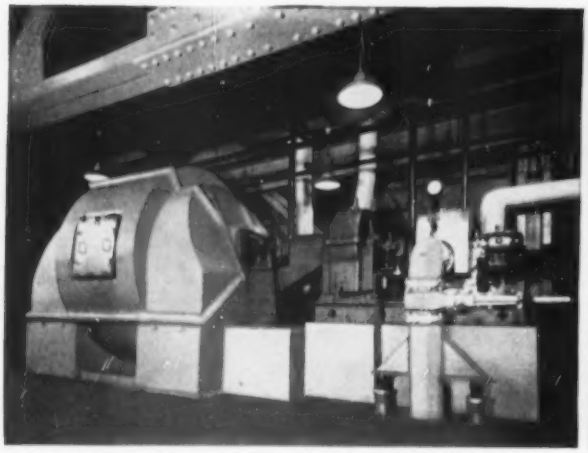
TRAPS · VALVES · FLOATS

160 OREGON ST., WILKES-BARRE, PA.

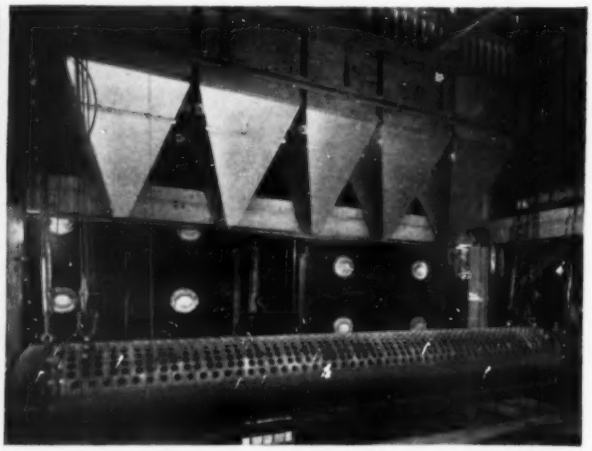
Sales and Engineering Offices in 58 Principal Cities

For more data circle 532 on Post Card

Impressive Perry K Plant (above) has installed capacity of 1,900,000 lbs. of steam per hour. Indianapolis Power & Light Company has four other plants of which the White River Plant is newest and largest.



One of the American Blower Induced Draft Fans at the Indianapolis Power & Light Company's Perry K Plant. Rated at design point for 200,000 cfm at 620° F., 730 rpm, with 9" sp.



Looking at #15 boiler area at Perry K Plant, you see IP&LC's American Blower Dust Collectors before operation. Each is rated at design point for 200,000 cfm at 620° F., with 4.25" sp.

Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &**

Indianapolis Power & Light Company expands with Indiana

Business, employment and population are constantly growing in the 528-square mile area in central Indiana served by the Indianapolis Power & Light Company. To keep pace, IP&LC will have invested $132,000,000 for modernization and expansion in the 12-year period from 1946 through 1957. Now, the five generating plants provide a generating capability of 530,000 kw, which will be increased to 635,000 kw by the installation of a sixth White River unit by the end of 1955.

A progressive, investor-owned utility, IP&LC strives to give better service . . . to keep capacity higher than the increasing demand for abundant, low-cost electricity.

Every year since 1946, IP&LC has expanded its facilities . . . and, at the same time, reduced the average price of a kilowatt hour! IP&LC credits this record partly to new methods of operation and efficient equipment – including American Blower Forced and Induced Draft Fans, Vaneaxial Fans and Dust Collectors.

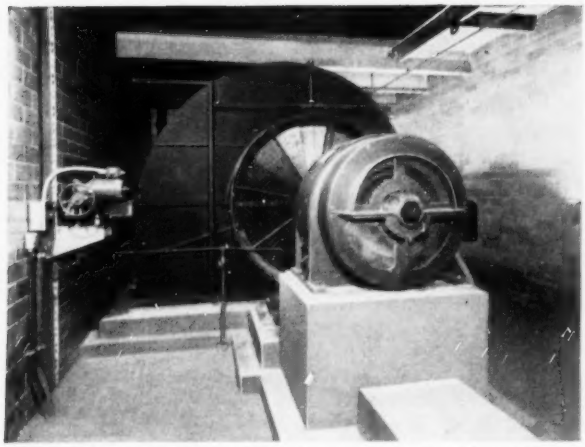
Power plant operators everywhere are specifying American Blower Mechanical Draft Fans, Dust Collecting Equipment, Fly Ash Precipitators and Gyrol Fluid Drive for boiler feed pump and fan control. They know they can depend on American Blower Equipment and technical assistance.

If you have an air handling problem, or plan to expand or modernize, contact your nearest American Blower Branch Office, or write us direct.

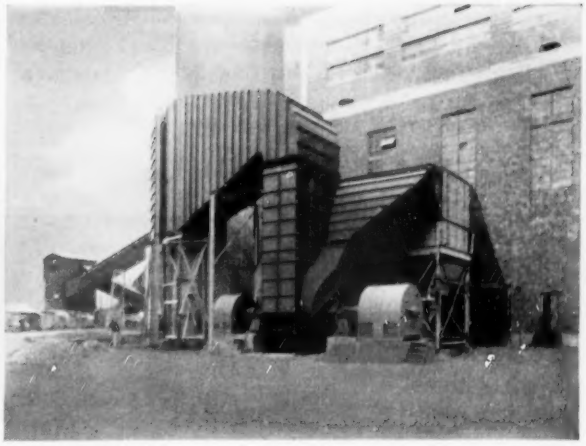
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER



American Blower Forced Draft Fan at the White River Plant. It is rated at design point for 190,000 cfm at 105° F., with 11.7" sp. Driving motor for fan develops 500 hp at 855 rpm.

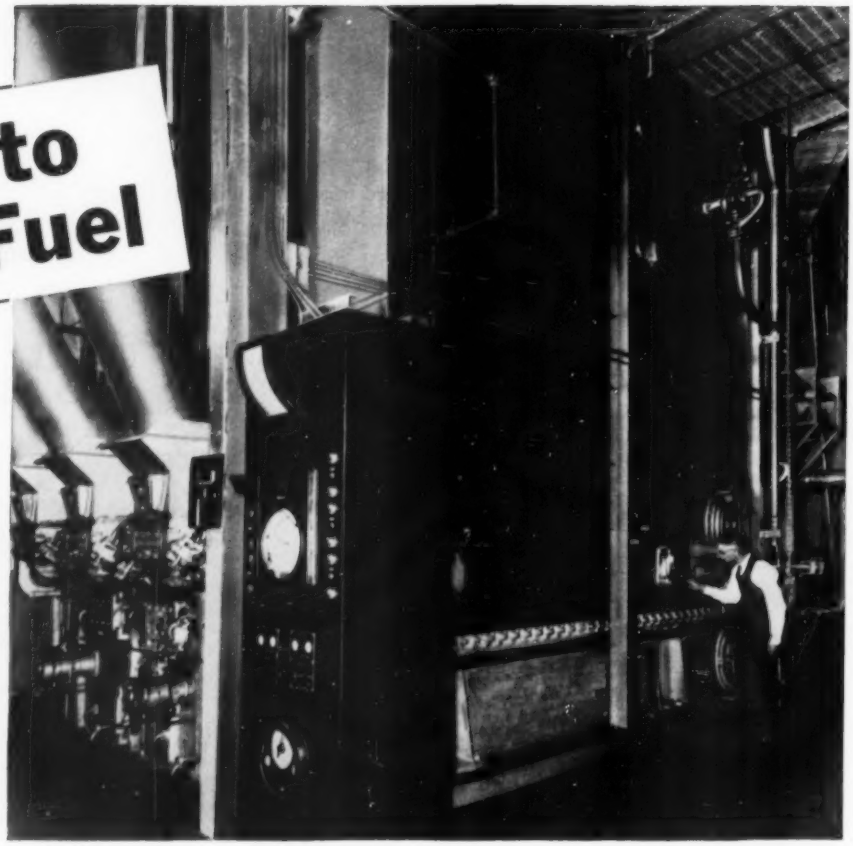


Outdoor installation at White River Plant of an American Blower Induced Draft Fan. Rated at design point for 335,000 cfm at 380° F., with 14" sp. Driven by 1250 hp, 585 rpm motor.

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

For more data circle 533 on Post Card

How to Save Fuel



Fuel savings of 15% have resulted from steam plant modernization at General Mills, Inc., Buffalo, N. Y. The program included this installation of Bailey Meter Control on a 45,000 lb per hr, 170 psi spreader stoker-fired boiler.

● The heat energy you get from a unit of fuel depends on the performance of your steam plant equipment. And that's where Bailey controls can help. With a Bailey-engineered control system you can count on a higher output of available energy per unit of fuel. Here's why:

1. Suitable Equipment

When you receive equipment recommendations from a Bailey Engineer his selections come from a complete line of well-engineered and carefully tested products.

2. Seasoned Engineering Experience

Your local Bailey Engineer brings you seasoned engineering experience based on thousands of successful installations involving problems in measurement, combustion, and automatic control.

3. Direct Sales-Service—close to you

For your convenience and to save time and travel expense there's a Bailey District Office or Resident Engineer in or close to your industrial community.

For greater fuel savings, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're glad to stand on our record. A-121-1

FORMULA
for Cutting Production Costs
•
+ Bailey Design
+ Bailey Engineering
+ Bailey Service
= Greater Savings per Fuel Dollar

BAILEY
METER COMPANY
1040 IVANHOE ROAD
CLEVELAND 10, OHIO
Complete Controls for Steam Plants

BAILEY METERS
Controls for
COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

For more data circle 534 on Post Card

ALL FORGED STEEL

Edward UNIVALVES

Lower Pressure Drop 25-50% with Straight-Thru Flow

As shown photographically here, the streamlined internal contours and the inclined stem construction of the Edward Univalve give straight through flow — which careful laboratory tests have shown to result in pressure drop 25 to 50% lower for Univalves than other globe valve types. Turbulence, too, is greatly lowered by these streamlined contours. And lowering turbulence lengthens valve life by eliminating vibration, the principal cause of wear in small globe valves.

But lower-pressure drop and less turbulence are not the only reasons the Univalve has become an industry standard for tough high pressure, high temperature services. Here are just a few of the benefits which add up to longer life and lower maintenance for this outstanding all forged Steel Valve.

LONGER PACKING LIFE **through a positive backseat and deep cooling chamber which protects packing in service. Isolation of packing prevents blow-out when repacking under pressure.**

PERFECT ALIGNMENT, EASY DISASSEMBLY **when necessary, through foolproof patented body-bonnet connection.**

EXTRA WEARING SEATING SURFACES— **seat formed by application of continuous ring of Stellite to valve body; Stellite hard-facing applied to alloy steel disk.**

EASY PACKING ADJUSTMENT **with through bolted, accurately guided gland.**

EFFORTLESS SEATING **with Impactor handwheel in sizes 1¼ in. and larger.**

DESIGNED FOR HIGH-PRESSURE, HIGH-TEMPERATURE APPLICATIONS
Two different classes rated for 1500 lb sp at 1023F or 2500 lb sp at 1033F.

AVAILABLE IN A WIDE RANGE OF SIZES
Furnished in 1500 lb or 2500 lb pressure classes in sizes from ½ in. to 2 in.

CHECK VALVES, TOO
Check type Univalves, of spring loaded piston design, have the same basic construction as globe Univalves. Use them together for all welded construction for small pipe lines, eliminating all bonnet joint leakage problems.

IDEAL FOR BLOW-OFF SERVICES
Univalves meet all ASME code requirements for blow-off service and are adaptable for high pressure installations to 3120 psi boiler pressure.

Get the full story on Univalves, ideal all-purpose steel valves—write for Catalog 12G1.

Rod through Univalve demonstrates straight thru flow of this valve.

Edward Valves, Inc.
Subsidiary of ROCKWELL MANUFACTURING COMPANY
220 West 144th St., EAST CHICAGO, INDIANA

Another Product

Fuel Economy for EVERY SIZE OF

Fuel economy is just as important for the small or medium-sized boiler plant as it is for the large plant. For any number or size of boilers, at any steam pressure and temperature, Hagan Automatic Combustion Control and Ring Balance Instruments Systems are designed to attain the maximum economy of fuel.

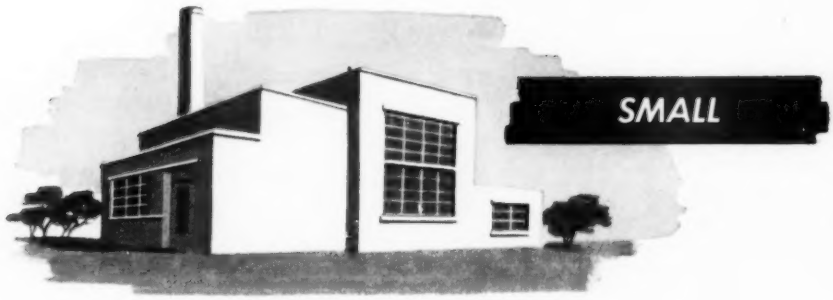
The systems used in smaller plants need not be as elaborate as in the larger plants, but all must meet the highest standards of performance.

Whether simple or more extensive, every Hagan system is the assembly of accurate and dependable units in a coordinated system requiring minimum maintenance. The fuel savings normally pay for the system within the first year. Subsequent savings are clear profit.

Hagan engineers will be glad to show you how Hagan Automatic Combustion Control and Ring Balance Instruments can be fitted to your exact needs, and can save your fuel dollars.

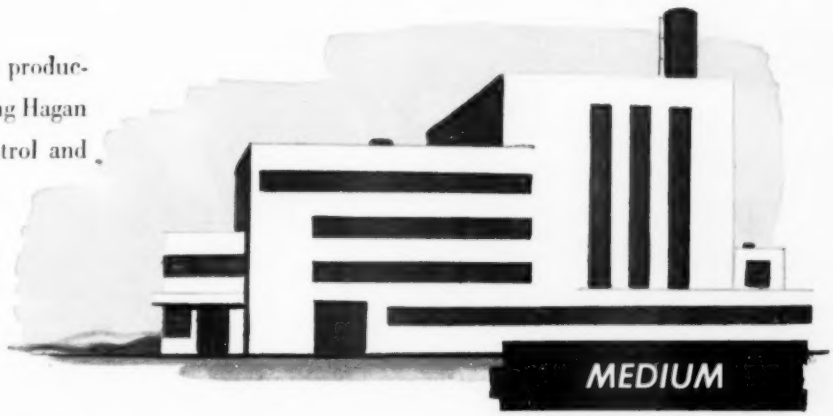
HAGAN Automatic Combustion Control

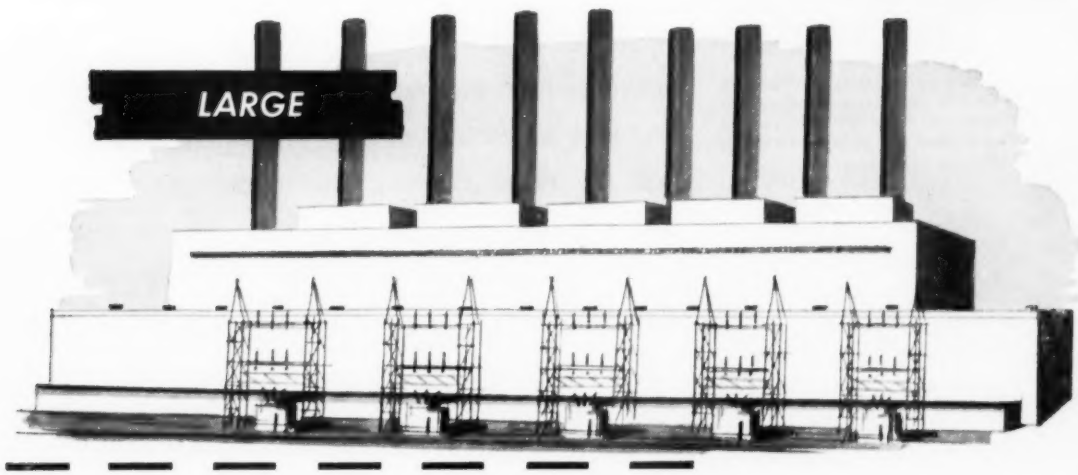
HAGAN Ring Balance Instruments



BOILER PLANT

Save fuel—and keep steam production costs down—by installing Hagan Automatic Combustion Control and Ring Balance Instruments in your boiler plant.





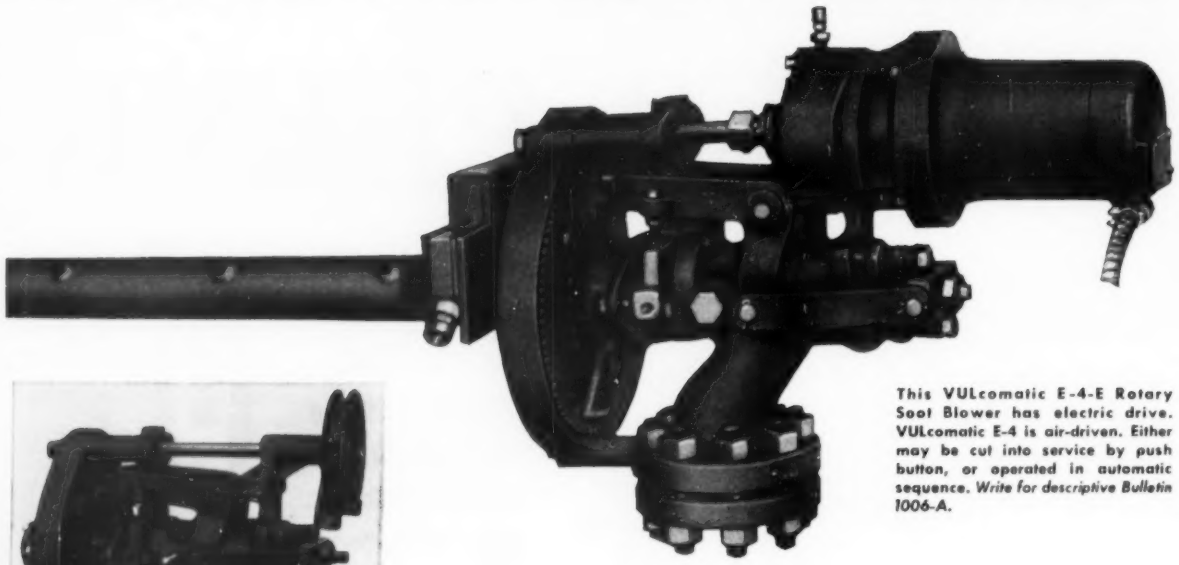
HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PENNSYLVANIA

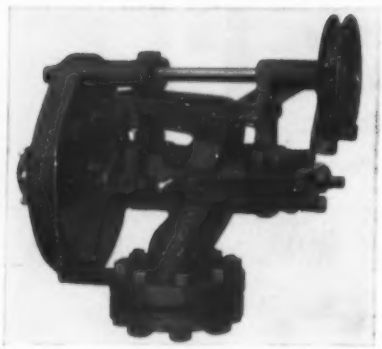
Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems Control Systems for Automatic and Aeronautical Testing Facilities

For more data circle 536 on Post Card

Here's the answer to SOOT *and* DUST REMOVAL



This VULcomatic E-4-E Rotary Soot Blower has electric drive. VULcomatic E-4 is air-driven. Either may be cut into service by push button, or operated in automatic sequence. *Write for descriptive Bulletin 1006-A.*



Manually-operated Vulcan P-3 is identical with VULcomatic E-4-E or E-4, except for drive. May be quickly converted to an automatic unit by replacing sheave wheel with air or electric motor. *Bulletin 1005-A.*

MOTOR DRIVE or MANUAL

With Vulcan Rotary Soot Blowers, you get full cleaning pressure—from the crack of the valve to the end of the cycle. Exclusive trigger-action valve assures uniform speed of rotation for better cleaning, and closes automatically. While closed, it seals off corrosive furnace gases to protect internal parts. You can install Vulcan Rotaries at any angle. You can inspect or repair any part—with an ease that saves maintenance time and money.

COPES-VULCAN DIVISION
Continental Foundry & Machine Company
ERIE 4, PA.

VULCAN Rotary SOOT BLOWERS

For more data circle 537 on Post Card

4 GOOD REASONS for specifying Watson-Stillman Forged Steel Fittings

Here's why **W-S FORGED STEEL FITTINGS** mean safe, dependable operation of your piping system:

1. They're *drop-forged* to produce the well-known forged fiber structure with exceptionally high tensile and impact strength.

2. They're "Safety-Factor" designed with heavy walls where you need them. Extra long bands extend well beyond the last thread.

3. They're precision machined. Special automatic angle indexing machines maintain precise angular accuracy for perfect alignment. Long accurate threads insure tight joints.

4. They're fully inspected. Gauges double-check the close tolerances, angularity, threads and sockets and concentricity.

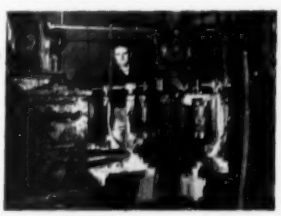
WATSON-STILLMAN FORGED STEEL FITTINGS give you maximum resistance to pressure, temperature, corrosion, shock and vibration. They protect your system against costly shut-downs.

A complete line of forged fittings available in both SCREW-END and SOCKET-WELDING types in carbon, stainless and alloy steels. Write today for information.

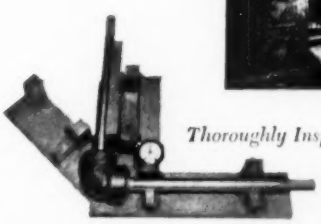
Sold Through Leading Distributors

Drop Forged for Strength

"Safety-Factor" Design



Precision Machined



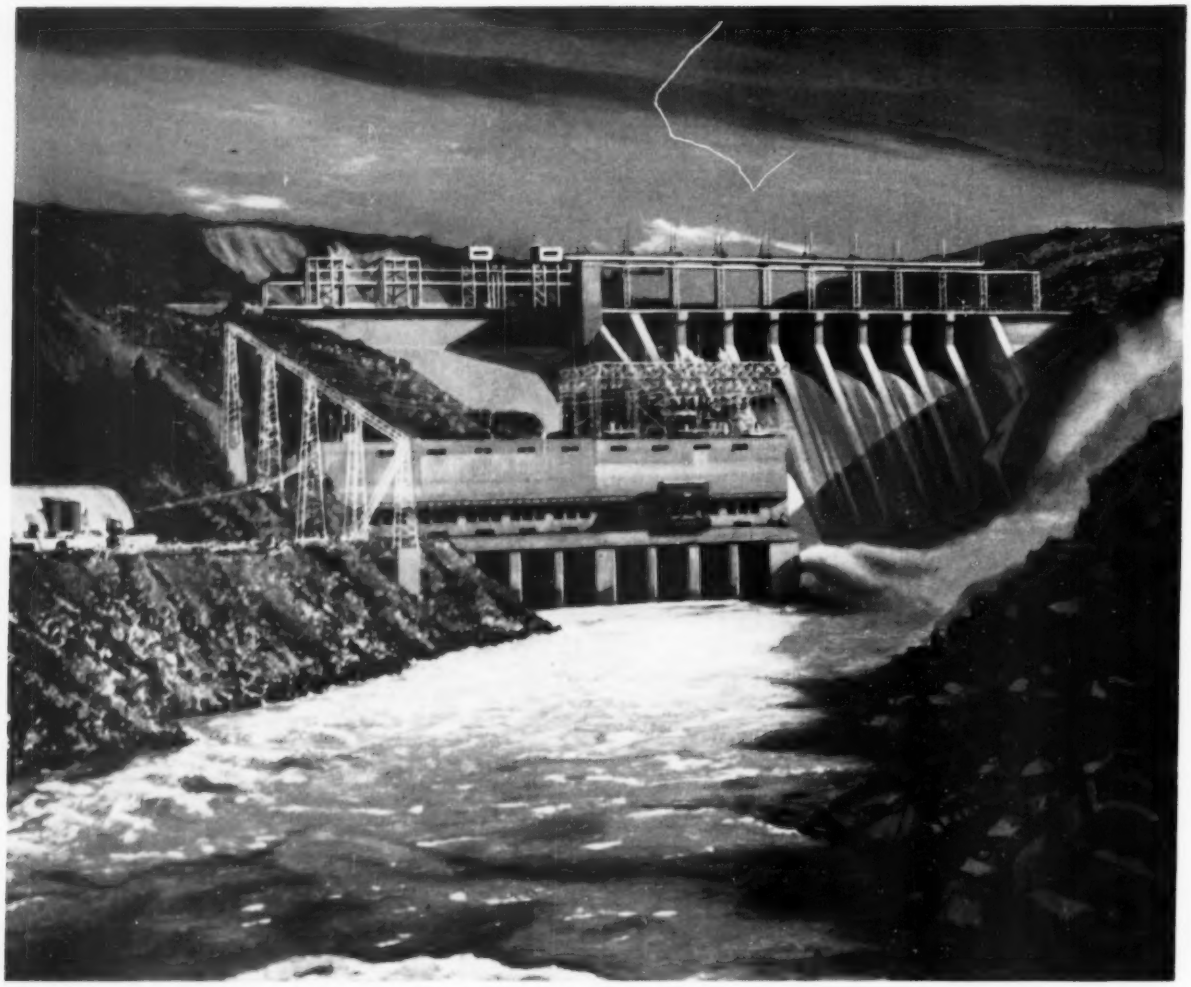
Thoroughly Inspected

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

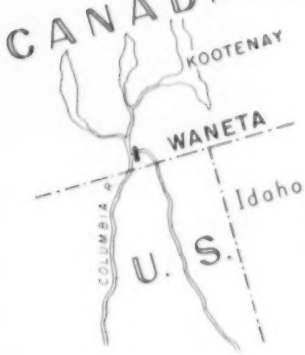
Roselle, New Jersey

For more data circle 538 on Post Card



Waneta's gravity type dam has a length on top of 950 feet and provides a head of 210 feet. The spillway allows for a maximum flow of 280,000 cubic feet per second.

WANETA *on the* PEND d'OREILLE



For The Consolidated Mining and Smelting Company, Trail, British Columbia, Stone & Webster Canada Limited, in collaboration with Stone & Webster Engineering Corporation designed and constructed the Waneta Hydroelectric Development.

Waneta, located on the Pend d'Oreille River just above its confluence with the Columbia, is designed for an ultimate capacity of 480,000 hp.

The first two units, of 120,000 hp. each, are already on the line.

Write or call us for detailed information as to how our engineering, design, construction, report and appraisal services may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Toronto

For more data circle 539 on Post Card

NEW OPTICAL METHOD ALIGNS

TURBINE GENERATOR CYLINDERS
PEDESTALS • BLADE RINGS • DIAPHRAGMS
SOLE PLATES, ETC.

MORE ACCURATE
SAVES MONEY
SAVES TIME

Alignment telescopes are now used by The CONSOLIDATED EDISON COMPANY OF NEW YORK and other electric utilities to align turbine generators:

*

"Alignment-telescope method is more accurate, less costly, takes less time . . . permits other work to go on in area, even installing or removing of internal turbine parts."

Ref:—POWER, Vol. 98, No. 5, May, 1954

NOW...

The optical method is used to establish a straight line of sight by means of an alignment telescope trained on targets which are positioned in the gland bores of the turbine. Pedestals, diaphragms and other parts can then be positioned relative to this line of sight simply by looking through the telescope.

This new method helps reduce "outage" time, is precise, fast and dependable.

The method is not complicated and regular plant personnel learn how to use it quickly and easily.

A conservative estimate of "outage" time savings by use of the optical method, compared with old mechanical technique is 50%. Cases on record show that setting diaphragms in a single cylinder machine took only 3 *hours* as compared with 2 weeks by the old method!

For additional information and data SEND FOR BULLETIN NO. 815

PRECISION OPTICS
ELECTRONIC AND SCIENTIFIC INSTRUMENTS

FARRAND
OPTICAL COMPANY, INC.

Engineers, Designers and Manufacturers

BRONX BOULEVARD AND EAST 238th STREET, NEW YORK 70, N.Y.

For more data circle 540 on Post Card

"We had a picnic on the boiler room floor"

"When the Chief Engineer recommmended coal-burning boilers for the new plant, one of the directors asked if coal wouldn't make the plant dirty.

"That made the Chief mad! He didn't say anything at the time, but at the first board meeting after the new plant was finished he invited the directors down for lunch.

"You should have seen their eyes! The place was hospital clean. And why not? The coal came into the stoker through dust-tight chutes, and the ashes were piped out through pneumatic tubes.

"While the directors were eating, the Chief gave them a chalk-talk. On one side of the blackboard he had charted the savings through the use of of coal as compared with other fuels. On the other side he had a comparison of our proven reserves of the various fuels showing that while other fuels are growing scarcer, we have barely scratched the surface of our almost inexhaustible coal deposits."

COAL
FUEL OF THE FUTURE

Chesapeake and Ohio Railway

Bring your fuel problems to C&O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

Write to
Coal Traffic Department
Chesapeake and Ohio Railway
2116 Terminal Tower
Cleveland 1, Ohio

For more data circle 541 on Post Card

Here's Help in Understanding STEAM-WATER CYCLE ANALYSES

OFTEN, constituents of deposits in steam-water cycles are reported to you in mineral names rather than chemical formulas. To help you better understand reports and analyses with these names, Allis-Chalmers has published a new Informational Bulletin, Number 59. It lists each mineral, then gives the chemical formula, the usual area in which these deposits are found, and the causes and possible preventive measures you can take.

Part of Practical Library

Only careful analysis of all the factors in the cycle can solve a specific water problem. This bulletin will help you understand, generally, the causes and solutions of a variety of water problems. It is one of a series published by Allis-Chalmers. These bulletins reflect Allis-Chalmers wide experience from years of solving water problems in every industry, in addition to solving problems involved in the company's own broad line of power plant equipment.

ALLIS-CHALMERS
WATER CONDITIONING
Equipment — Chemicals — Service

Complete Water Conditioning Service

Allis-Chalmers offers complete water conditioning service. You can get analyses and reports on your problems. You can get chemicals needed for water treatment. And you can get the equipment needed for any system.

For your copy of Informational Bulletin 59 explaining the mineral names used in analyses, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby A-C office to have an Allis-Chalmers water conditioning engineer consult with you on your problem. A-4414

Complete investigative facilities at Allis-Chalmers research laboratories include this X-ray diffraction unit which is used to analyze crystalline structure of deposits from steam-water cycles.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

For more data circle 542 on Post Card

Utility company in Texas successfully combats corrosion with U. S. Uscolite Pipe in 6 of its plants

All 6 plants use chlorine to control slime growth in "cooling water." One of the 6 plants (shown below, in Corpus Christi, Texas) also uses chlorine to control marine growth in sea water used exclusively for cooling. In addition, this plant uses Uscolite pipe to combat another enemy—high salt content of soil which corrodes metal pipe from outside and causes failure. These are the reasons why the utility company changed from iron pipe (which lasted only 4 years) to Uscolite® pipe, which is expected to last 30 years. Unlike other piping, Uscolite is not attacked by chlorine or most chemicals, or even sea water.

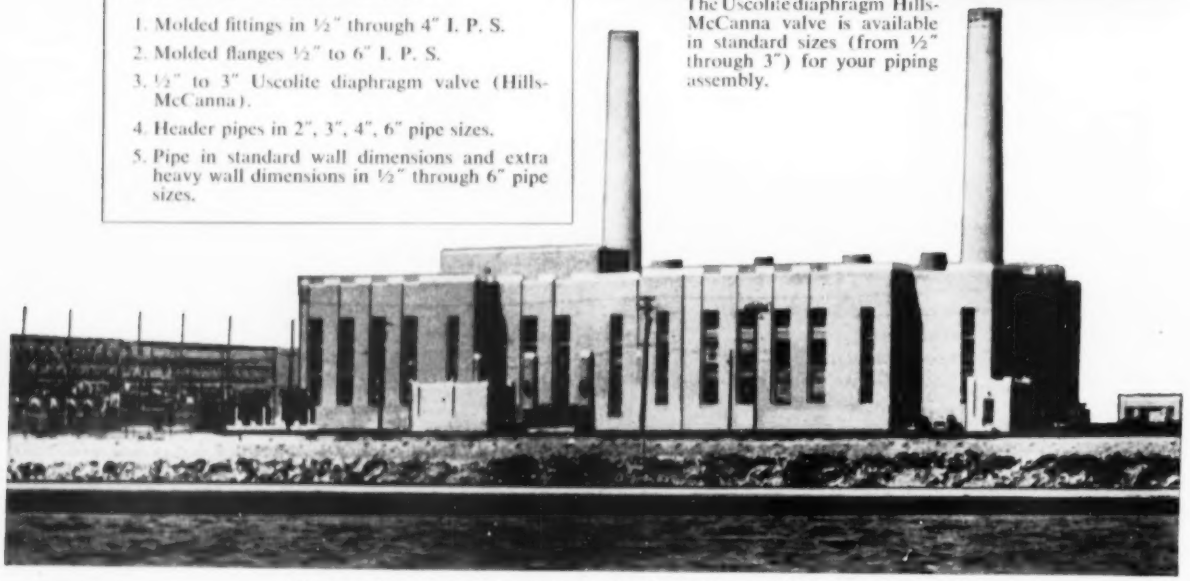
Uscolite is manufactured exclusively by United States Rubber Company. It has extremely high impact strength, high endurance, needs absolutely no maintenance, is very lightweight. It is available in standard lengths, and can be cut to length and threaded on the job.

Uscolite is the answer to corrosion and maintenance problems in piping. Any of the 27 "U. S." District Sales Offices will provide complete assistance and facts. Or get in touch with any of our selected distributors or write to address below.

Uscolite pipe and fittings come in the broadest and largest line of stock sizes of plastic pipe on the market. Sizes follow:

1. Molded fittings in ½" through 4" I. P. S.
2. Molded flanges ½" to 6" I. P. S.
3. ½" to 3" Uscolite diaphragm valve (Hills-McCanna).
4. Header pipes in 2", 3", 4", 6" pipe sizes.
5. Pipe in standard wall dimensions and extra heavy wall dimensions in ½" through 6" pipe sizes.

The Uscolite diaphragm Hills-McCanna valve is available in standard sizes (from ½" through 3") for your piping assembly.



**Above is photo of one of the plants, owned by Central Power & Light Co., Texas*

US RUBBER

"U.S." Research perfects it..."U.S." Production builds it...U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

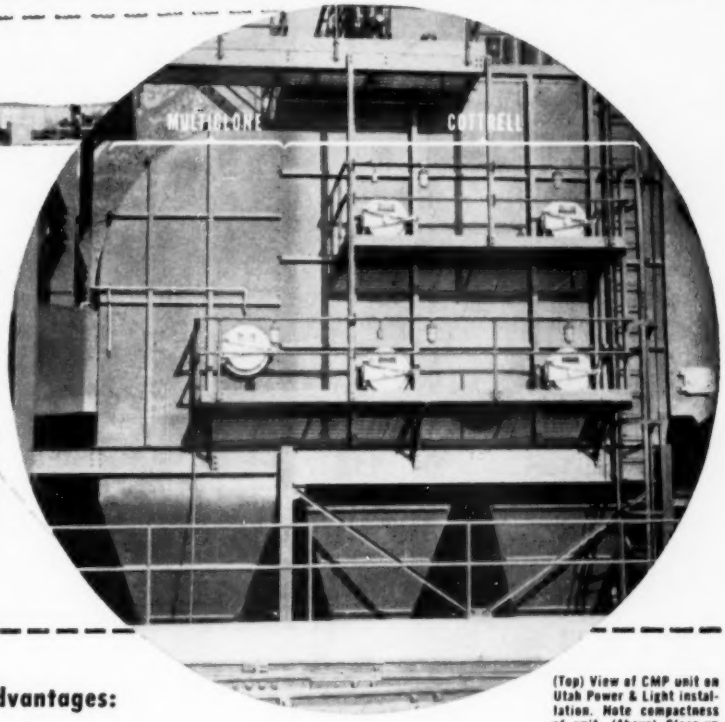
MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

For more data circle 543 on Post Card

Planning A Fly Ash Recovery Installation?

Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!



IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter) . . . and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down . . . while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

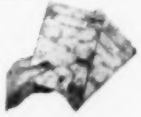
Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields . . . knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job . . . and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

Send for descriptive literature!



WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

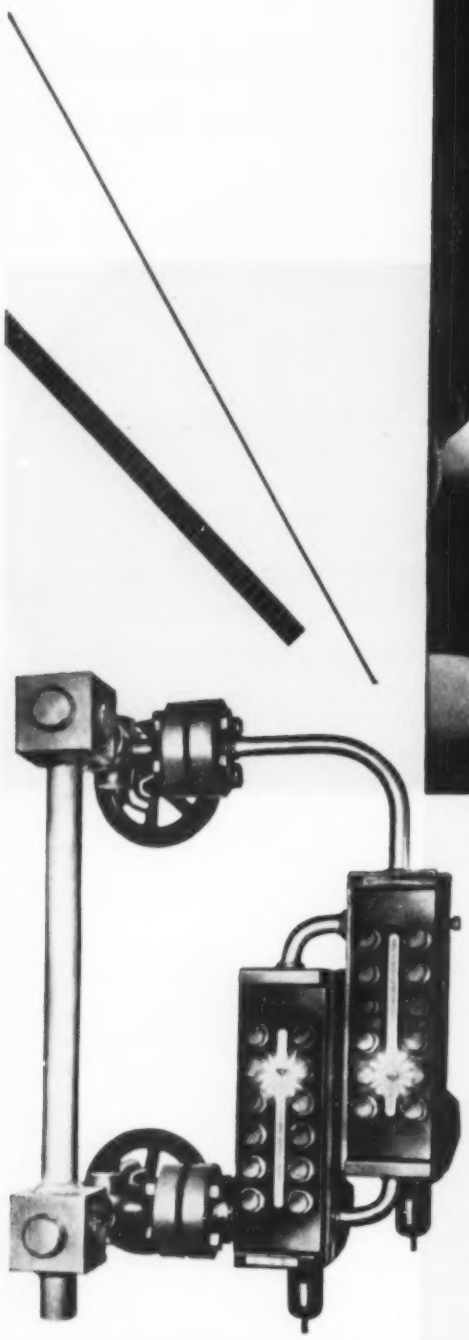
Main Offices: 1029 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA

CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2

1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4

PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

For more data circle 544 on Post Card



Yarway High Pressure Boiler Water Gage with separated-design flat glass inserts. Write for Yarway Bulletin WG-1812

HE'S A SPECIALIST ON STAINLESS STEEL INLAYS

● A dentist? No.

He's a Yarway craftsman. In the picture above he is milling a gasket groove in the stainless steel facing that is used for this important part of a high pressure boiler water gage body.

The man is important; so is the inlay.

The man is typical of the skilled workmanship that goes into every Yarway gage, blow-off valve, steam trap or other product —workmanship that makes no compromise with quality.

The stainless steel facing is typical of advanced Yarway engineering design. That inlay is but one of twelve basic improvements made in Yarway high pressure water gages.

When buying boiler water gages as well as other steam plant equipment, measure the cost in terms of good engineering, quality, workmanship, and dependable service.

"Make Yarway your way."

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY

steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

For more data circle 545 on Post Card

PRACTICAL RADIOACTIVITY

While atomic power has been hogging most of the publicity, radioactivity has been quietly establishing itself as a remarkable new industrial tool. On the next two pages we show some of its present applications. These are not laboratory experiments, but practical examples of the many ways in which it is already being widely used by modern industry

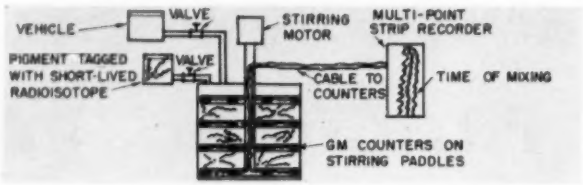
If you want to keep up-to-date on latest developments in the practical application of atomic energy, and if you want this information explained in easy terms the layman can understand, you should read ATOMICS, a periodic news-letter written by A. W. Kramer, Editor of POWER ENGINEERING and authority in the field of nuclear physics, whose clear explanations of atomic energy are already familiar to our readers. If you want to be put on the mailing list to receive this news-letter free of charge each time it is published, write to the Editor, or just write ATOMICS on one of the prepaid postcards elsewhere in this issue and mail it in to us

PRACTICAL RADIOACTIVITY . . .

If you want more information about any of the applications shown here, write to the Editor, or use one of the prepaid postcards elsewhere in this issue. Just write RADIOACTIVITY, together with the particular application that interests you, and mail it in to us. For a list of suppliers of radioactive isotopes for industrial use write SUPPLIERS on the card

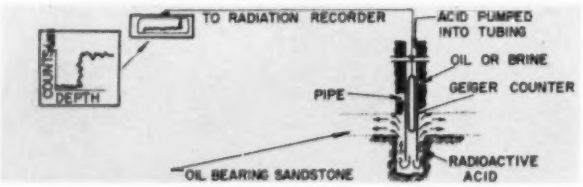
RADIOACTIVE ISOTOPES
FOR MEASURING UNIFORMITY OF PAINT MIXING

ADVANTAGES:
1. Yields continuous mixing data
2. No interference with normal mixing
3. Gives design data for better mixers



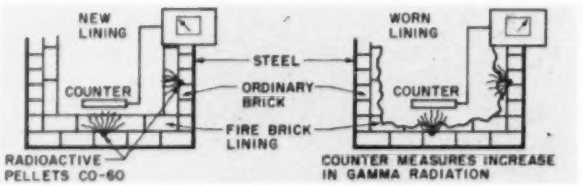
RADIOACTIVE ISOTOPES
FOR CONTROL OF OIL WELL ACIDIZING

ADVANTAGES:
1. Increases oil production efficiency
2. Saves time and money
3. Less hazardous than removing pipe



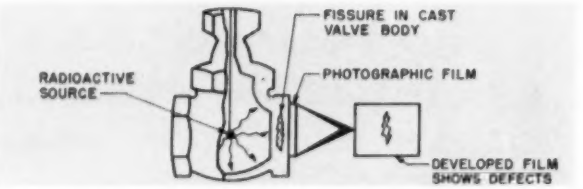
RADIOACTIVE COBALT 60
FOR MEASURING FIREBRICK LINING WEAR

ADVANTAGES:
1. Permits non-destructive testing
2. Measures wear in several locations
3. Normal operation while testing



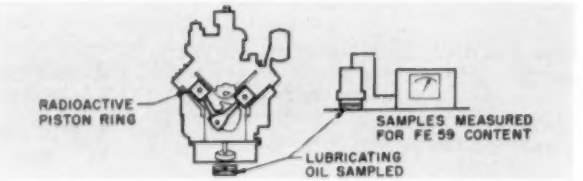
RADIOACTIVE ISOTOPES
MEASURING THICKNESS AND DEFECTS IN CASTINGS

ADVANTAGES:
1. Versatile and reliable inspection
2. Inspection without dismantling
3. High activity at low cost



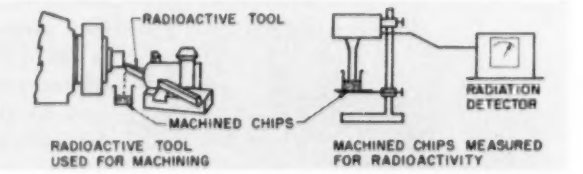
RADIOACTIVE IRON—Fe59
FOR FRICTION AND LUBRICATION STUDIES

ADVANTAGES:
1. Gives metal transfer to 0.000001 oz
2. Oil sampled during operation of motor
3. Film shows location of wear



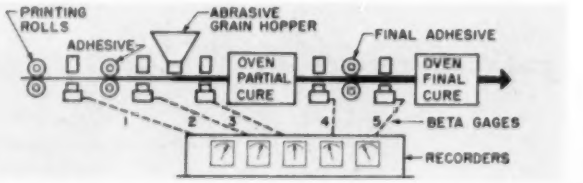
RADIOACTIVITY TESTS
MEASURING CUTTING TOOL WEAR AND LIFE

ADVANTAGES:
1. More sensitive than other tests
2. Faster and more efficient
3. Yields knowledge of wear process



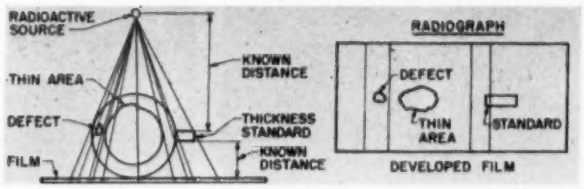
MULTIPLE BETA GAGES
FOR MEASURING PRODUCT THICKNESSES

ADVANTAGES:
1. Improves quality control
2. Measures variety of materials
3. Measurement is continuous



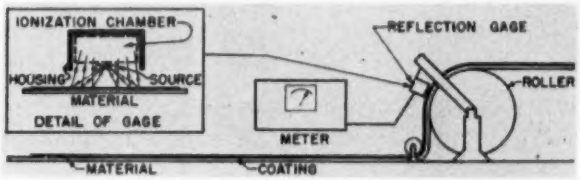
RADIOACTIVE COBALT
FOR RADIOGRAPHY TESTING

ADVANTAGES:
1. Versatile and reliable inspection
2. Inspection without dismantling
3. High activity at low cost



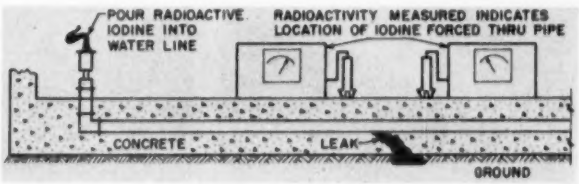
RADIOACTIVE SOURCE
FOR REFLECTION THICKNESS GAGE

ADVANTAGES:
1. Measures coating and/or material
2. Can measure from one side only
3. Many materials with one calibration



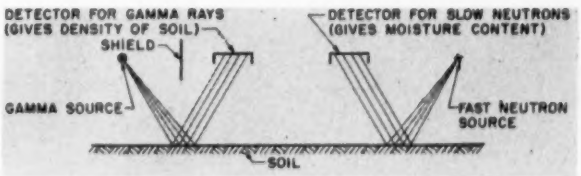
RADIOACTIVE IODINE—I.131
FOR DETECTING LEAKS IN WATER LINES

ADVANTAGES:
1. Not necessary to remove floors
2. Less costly and more convenient
3. No residual activity



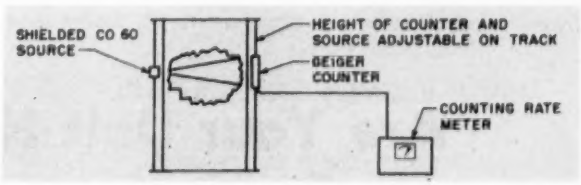
DENSITY AND MOISTURE IN SOIL
THIS BASE SOIL DATA IMPORTANT IN ROAD BUILDING

NOTES:
1. Data obtained without moving soil
2. Gamma ray detector measures density
3. Slow neutron detector shows moisture



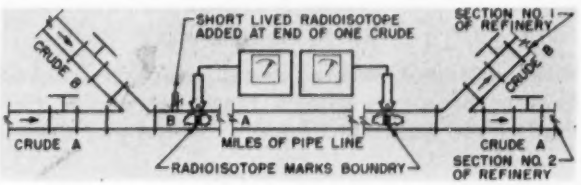
RADIOACTIVE COBALT—Co60
FOR INDICATING LIQUID LEVEL

ADVANTAGES:
1. Unaffected by corrosion, temperature
2. Used by non-technical personnel
3. Automatic recording and control



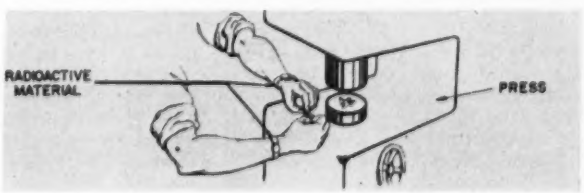
RADIOACTIVE ISOTOPES
FOR TRACING OIL FLOW IN PIPELINES

ADVANTAGES:
1. Marker can be traced long distance
2. Crude separation with minimum loss
3. Method quick and needs no sampling


SHORT LIVED RADIOISOTOPE ADDED AT END OF ONE CRUDE
SECTION NO. 1 OF REFINERY
CRUDE B
CRUDE A
MILES OF PIPE LINE
RADIOISOTOPE MARKS BOUNDRY
CRUDE A SECTION NO. 2 OF REFINERY

PUNCH PRESS OPERATOR SAFETY

ADVANTAGES:
1. Machine cannot be started unless operator wears wrist bands
2. If bands approach too near dangerous area of machine it stops, even in mid-stroke



RADIOACTIVE BEADS
FOR CONTROLLING CATALYST FLOW RATE

ADVANTAGES:
1. Improper operation indicated at once
2. No interference with production
3. Flow may be adjusted automatically

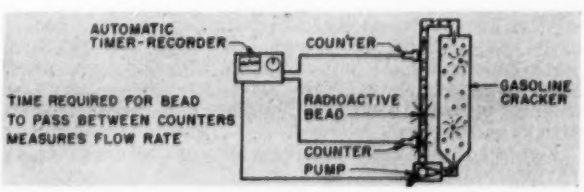


Fig. 1. Typical steam heated unit heater

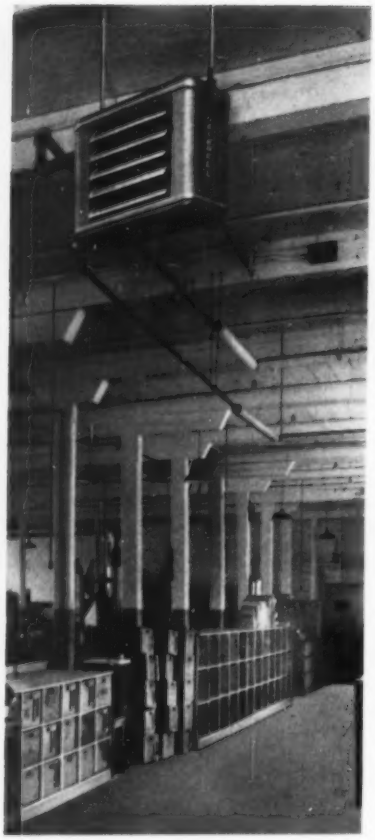


Fig. 2. Typical gas heated unit heater

Are Your Unit Heaters Ready for Winter?

Now's the time, before the cold weather, to overhaul your unit heaters to be sure they're ready for winter. Here's a program that's good both for annual overhaul and routine maintenance

By LAWRENCE L. MORAN, JR.

BECAUSE OF their space-saving features and their high operating efficiencies, unit heaters can be used very effectively in heating and ventilating industrial buildings of all types and sizes. If properly installed and operated this type of heater can be a powerful aid in reducing heating costs, while maintaining maximum comfort for workers or protection of stored goods. However, in order to insure continuous, efficient and trouble-free operation, an extensive maintenance program should be established and rigorously followed.

Figure 1 shows a cutaway view of a typical suspended-type unit heater. Its components are (1) heating surface, (2) motor and fan, (3) louvers and casing. The heating medium, either steam, hot water or gas, is piped to the heater as shown in Fig. 2. The air is heated as it is drawn over the heating surface by the fan. The area of space being heated may be varied by operation of the louvers. If the unit is being used for both heating and ventilating, outside air is conveyed to the heater inlet by metal duct work.

In setting up a maintenance program, it is usually advisable to divide the work into three categories: namely, piping, electrical and duct work. This arrangement will permit the work to be planned and assigned in an efficient manner, and will insure that each component receives specialized attention. Maintenance problems encountered in each of the above categories will now be discussed.

The entire piping system with the exception of the heating surface and the return line traps should be inspected at least twice a year. The heater should be in operation when these inspections are made. Maintenance check points for the piping system are listed in Fig. 6. In determining the frequency of cleaning for the heating surface, the amount of dust and dirt in the prevailing atmosphere should be considered. After this factor has been studied, a cleaning schedule should be set up and closely maintained. Dirty heating surfaces usually result in reduced heating efficiency which can cause hazardous conditions especially during the winter season.

Cleaning

Listed below are several methods that may be employed in cleaning the heating surface.

(1) The simplest and least expensive cleaning can be accomplished by brushing the fins on the air-intake end of the heater and then turning on the fan. Provision should be made to catch the dirt as it is blown from the unit.

(2) A high-pressure air hose applied at the outlet end of the heating surface is an efficient means of removing dirt and dust.

(3) If the first two methods are insufficient, or if large amounts of grease have accumulated on the heating surface, it is recommended that the motor be removed from the unit and the entire heating surface be washed with a mild alkaline cleaning solution. This method of cleaning can be performed conveniently with a spray gun.

Corrosion of the heating surface is generally caused by impurities contained in the heating medium, and elimination of these impurities requires a complete investigation of the medium. Corrosion may sometimes be prevented by deaerating the boiler feed water, particularly if large amounts of make-up water are used. Boiler compounds should be used with great care, as excessive use of these compounds may cause an acid condition that can attack the heating surface metal. Adequate air venting of the heaters is essential especially when high-pressure steam is being used. The heater and attached piping should be installed in a manner that will allow rapid drainage of condensation. Condensation will not only cause corrosion but if allowed to remain on the heating surface, may freeze and cause rupture of this element.

All return-line traps should be thoroughly inspected and cleaned three or four times a year. Parts that leak or stick must be replaced. Most traps employ intricate operating mechanisms, and repair or adjustment of these mechanisms should be made only after consulting the trap manufacturer's service or maintenance literature. Several spare trap units

should be kept in stock. When ordering replacement traps be sure the pressure rating specified is equal to or exceeds the system pressure.

This part of the maintenance program should be stressed very strongly, as neglect of the electrical equipment can result in costly breakdowns involving not only damage to motors and control equipment but also loss of production or spoilage of stored goods. The electrical system may be divided into two classifications, (1) motor and fan, (2) control equipment. The routine maintenance checks for both classifications are listed in Fig. 3.

Lubrication of motors must be performed in strict accordance with the manufacturer's specifications. Excessive lubrication may force the grease to come in contact with and impair the electrical circuit. When using power-grease guns, extreme care should be taken not to force excessive amounts of grease into the bearings.

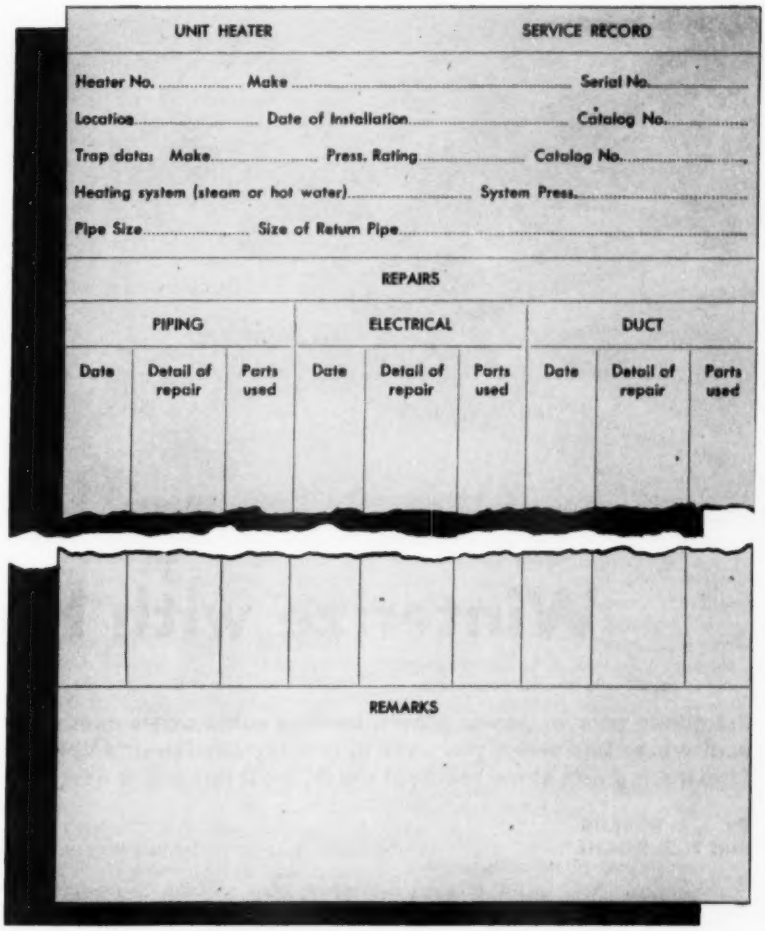
Ball-bearing motors are usually shipped with sufficient lubrication for 2,000 hours of operation, and hence do not require attention when installed. This type of motor may be lubricated every six to eight months if the heater is used constantly, or at the start of each heating season if the unit is used for heating only. Sleeve-bearing motors require lubrication before being placed in service and every 2,000 hours thereafter.

Starting Switches

Motors equipped with centrifugal starting switches may burn out if this switch fails to operate. It is therefore wise to check the starting characteristics of these motors at frequent intervals. Failure of the motor to reach rated speed within five or 10 seconds after being turned on, indicates that the starting mechanism is defective and requires adjustment or replacement.

The external surface of the motor frame should be kept free of accumulations of dust and grease. These accumulations will not only present a fire hazard but will deprive the motor of needed air circulation. It is considered good practice to completely dismantle all motors every two or three years. During this operation the motor is to be thoroughly cleaned both inside and out. Ball bearings may be washed out with gasoline and supplied with fresh grease after the gasoline has been removed. Wool-packed sleeve bearings should also be washed and the original wool cleaned or replaced with new packing. The motor windings *continued on page 102*.

If you want copies of this maintenance program write to the Editor or use one of the prepaid post cards elsewhere in this issue. Just write UNIT HEATERS on the card and mail it to us



UNIT HEATER — SERVICE RECORD

Heater No. ..... Make ..... Serial No. .....

Location ..... Date of Installation ..... Catalog No. .....

Trap data: Make ..... Press. Rating ..... Catalog No. .....

Heating system (steam or hot water) ..... System Press. .....

Pipe Size ..... Size of Return Pipe .....

REPAIRS

PIPING			ELECTRICAL			DUCT		
Date	Detail of repair	Parts used	Date	Detail of repair	Parts used	Date	Detail of repair	Parts used

REMARKS

UNIT HEATER MAINTENANCE CHECK LIST

PIPING SYSTEM			ELECTRICAL			DUCT		
Part	Inspection Dates	Items Checked	Part	Inspection Dates	Items Checked	Part	Inspection Dates	Items Checked
Piping		Leaks	Motor		Lubricate	Intake Duct		Clean
		Corrosion			Inspect bearings			Paint
		Defective unions or couplings			Speed check			Check for air leaks
		Inspect and clean heating surface			Check starting switch	Casing		Clean
		Inspect and clean buckets and thermostatic elements of traps and air valves			Clean outside of frame	Louvers		Clean
					Shellac windings	Fan Guards		Paint
		Check return line for sediment			Dismantle and check all parts	Holding Bolts		Clean
		Check seats, hand wheels and stems on all shut off valves	Fan Control Equip.		Clean blades			Paint
					Check thermostat & contacts			Check for tightness
					Check limit control & contacts			
					Check all wiring connections on thermostat, limit controls & breaker			

Fig. 3. In order to ensure that all unit heaters receive proper care and attention, each one should have one of the maintenance and service cards shown above. Top is a service record card and bottom a maintenance inspection check list card

Fig. 1. Sprinkler header tracing means prompt availability of water, even in areas hard to heat, when a fire occurs

Winterize with Heating Cable

Relatively new in power plants, heating cable offers controlled heat where and when you need it, low installation and upkeep. Pipe tracing and snow removal are its most important new jobs

By J. L. DEVLIN and T. J. ROCHE*

THOUGH heating cable is frequently specified "soil heating cable," there are many jobs it does well around any industrial plant — especially in winterizing applications — besides heating soil. It consists of a continuous resistance-type electric heater in the form of insulated resistance wire. Its principal industrial applications are the tracing of pipelines to prevent freezing (or congealing), and the removal of ice and snow from structures and paved areas.

In tracing applications, heating cable should be considered a device which prevents or limits the loss of heat from fluid within the pipe, but which is not intended to elevate the temperature of the fluid. Other heating devices immersed in or in series with the line would be more suitable for fluid heating almost without exception. In most power plant tracing installations, the cable is applied to prevent freezing of accumulated moisture in control air lines, condensate in return lines, and water in isolated and exposed pumps and water lines. Cable is sometimes used to trace heavy-oil lines between the plant and storage.

Snow and ice removal installations are most frequently placed in drives, walks, ramps, and loading platforms. It is not unusual to find them laid in rain gutters, roofs, downspouts, canopies, or structural members on which snow and ice accumulations are undesirable. Such snow removal systems usually evaporate the liquid immediately after melting since the relative humidity of air at the surface of the heated area is considerably lower than it is at ambient temperatures during snowfall.

Both applications of heating cable (tracing and snow removal) have the advantage of requiring operation only when their protection is needed. Steam tracing or jacketing might require continuous operation in cold weather to prevent freezing of the steam line itself. Heating cable can be switched off when the fluid flow and sensible heat of materials in the line would prevent freezing without the aid of outside heat. Steam or hot water heating coils used for snow and ice removal must have antifreeze additives for protection during shutdown.

An important application of heating cable is in the tracing of fire protection sprinkler headers. Remote areas of warehouses and storage spaces, especially near windows and doors, are danger spots for such pipelines. Since there is no flow through these pipes unless fire breaks out, they are especially susceptible to freezing.

It is necessary to remember that heating cable is a material with specific electrical characteristics, and

* Applications Engineers, Fred I. Tourtellot Co., Chicago, Ill.

Table I. Protection given uninsulated water pipes by one 400-w, 80-ft cable

Type of Installation	Pipe Diameters									
	¼-in.		⅜-in.		½-in.		¾-in.		1-in.	
	Deg F	Ft of Pipe	Deg F	Ft of Pipe	Deg F	Ft of Pipe	Deg F	Ft of Pipe	Deg F	Ft of Pipe
1 wire, straight along pipe	−12	80	− 5	80	+ 2	80	+ 7	80	+10	80
2 wires, straight along pipe	−28	40	−16	40	−10	40	− 5	40	− 1	40
16 spirals per ft at ¾-in. spacing	−34	33	−23	27	−18	22	−12	19	− 7	15
24 spirals per ft at ½-in. spacing	−65	23	−61	18	−56	15	−51	13	−47	10

Fig. 2. Snow-melting cable is attached to wire mesh, covered by 1 in. concrete

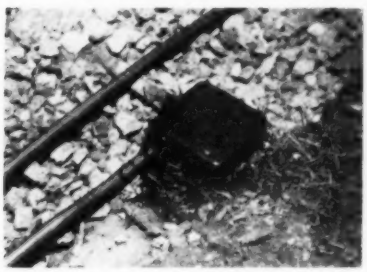


Fig. 3. Junction box is waterproofed by transformer compound, buried by paving

these must be considered when making installations. To prevent errors in applications, manufacturers supply "sets" or "loops" of heating cable with given electrical characteristics, which leaves the user with only two problems: connect to the proper voltage and apply the cable in such a way as to supply the necessary heat per unit length or area (see Table I and Table II). Manufacturers also supply reels of cable from which specially-designed heating circuits can be fabricated, but these usually require special consultation with the manufacturers' engineers.

Installation Details

If an installation of heating cable is to give proper service and require no maintenance, specific recommendations regarding actual installation should be heeded. First, consider the factors involved in the electrical tracing of piping.

Unprotected cable should never be located in an area where mechanical damage is considered likely. Always shield the cable from fork trucks, or other traffic which might cause such damage. The limiting temperatures for the cable selected should be investigated before proceeding with the installation, and this varies with the cable sheathing material. One manufacturer's specification limits neoprene jackets to 167 F service and silicone rubber jackets to 350 F service.

Table II. Design data for snow removal system using a 5-watt/ft heating cable

Distance Apart	Wattage per Sq Ft	Number of Linear Ft Cable per Sq Ft
2⅜-in.	25 w	5
2	30	6
1½	40	8

Tracing cable may be run straight along the pipe and attached with friction tape at 4-in. (or less) intervals, or it may be spiralled around the pipe *in pairs*. Never spiral a single strand of heating cable around a pipe since this constitutes an induction coil which would generate a back-emf, changing the electrical and heating characteristics of the circuit. Cable supplied in loops or sets is best suited to spiralling.

Never make crossovers where one part of the cable is in direct contact with another. The jacket at these points of contact will be heated excessively, which could lead to failure of the circuit. Where crossovers are absolutely necessary, cut a small plate (about 2 in. square) from roofing copper, sheet brass or galvanized steel 26 gage or thicker to interpose between the two conductors. This will spread the heat and reduce spot temperatures to a safe degree.

Allow a minimum of ½ in. between adjacent spirals of heating cable, otherwise a situation similar to direct contact in crossovers could occur. Any excess length of cable left over after applying a standard set or loop should be taken up by spiralling it around the pipe. Never cut a standard set to shorten it or pull the "hot section" into the conduit to take up slack. Only the cold lead should be inside conduit since the temperature of heating wire would build up to a higher and possibly unsafe level, while altering the length of a cable would alter its electrical and heating characteristics.

Outdoor pipe lines usually require insulation to prevent excessive heat loss, but lines with low flow rates are not insured against freezing by this simple measure. It is possible to trace such lines with heating cable which is controlled by a thermostat mounted inside the insulation against the pipe. This seldom requires any increase in the size of insulation for the pipe since both the cable and the thermostat can be fitted snugly to the pipe. The cable is switched on, of course, only when temperatures inside the insulation approach the coagulation or freezing temperature of the fluid. Use a U/L Listed line-voltage type thermostat large enough for the electrical load, and with a bulb which can be mounted against the pipe.

Design ratings of about 25 to 30 watts per square foot are generally found to be suitable for snow removal. Concentrating 40 watts per square foot will result in a higher removal rate, but is not generally considered necessary.

Manual control of snow removal circuits is generally preferred, but automatic devices can be obtained if desired. There are devices that actuate electric heating cable when a given amount of snow collects within a container, but these are too expensive for most practical applications. It is recommended that circuits for snow removal be isolated electrically so that it is possible to pull the fuses during summer to prevent accidental switching-on (and possible overheating) without interrupting other service.

Installation of snow-removal cable is quite simple since it is cast directly into the concrete of paved areas or laid onto open surfaces (such as marquee canopies). When it is to be cast in place, it is attached to the reinforcing wire and laid in place after the concrete has been poured to within ¾ to 1 inch of the desired depth. Installation is explained to a certain extent by Fig. 2 and Fig. 3. The latter shows the approved manner in which power is brought to the heating circuit through buried conduit and a junction box. Always fill the junction box with transformer compound to insure weather-proof connections. Specific recommendations are made in the 1953 National Electrical Code (Sections 4271 through 4286) for installing cable in masonry safely.

It is generally advised that sets of cable be confined to areas between expansion joints in concrete pavings. If the joints slip (crack) due to frost or summer heat, the heating circuit will be unaffected if separate circuits have been established for each section.

Installation in Macadam

Installation of cable in macadam is conducted after the material has been laid. This, of course, is poured hot and receives a severe rolling afterward — both of which would be quite hard on the cable. After laying, therefore, slots are cut at the desired spacing (see Table II) and the cable is driven into the slots. A tar compound which can stand up under the extremes of heat and cold is then poured on top of the cable, closing the slots. Connections are made in a similar manner to connections for concrete-imbedded cable.

Other applications of heating cable are constantly developing, both in industrial and domestic service. Snow removal from domestic premises is becoming popular, especially since no boiler or other heat generator is required. Direct radiant heat is to be tried, in an area with cheap electric power, by imbedding the cable in plaster ceilings. Heating of pump houses can employ a similar principle, though wrapping the equipment to be heated is usually more effective.

For more information about this useful heater, write "Heating Cable" on the card elsewhere in this issue, or write the editors.

Masonry Drilling

Choosing the Right Bit
Choosing the Right Drill

In our last two issues the authors explained the principles governing bit application for concrete and masonry drilling. Now they explain how these principles are applied in practice

By BERNARD L. CHAPIN*
and RALPH H. ALPER†

THE FIRST STEP in solving a drilling problem is to choose the correct bit for the job. If the material is beyond the range of rotary bits, a hammer bit must be used. The bit selector chart (Fig. 2) shows the range in materials which can be drilled by rotary bits.

The selector chart shows the different kinds of masonry material arranged by hardness and abrasiveness at the left, and the hole diameters at the bottom, with the recommended type of bit to use for any given material and hole size. There are certain overlapping areas where there is a choice of either a rotary or hammer bit. However, in general, the softer and less abrasive materials are easily drilled with the pointed type of rotary bit, and the harder and more abrasive — like hard concrete and vitreous tile — require a core type rotary bit. As the hardness and abrasiveness increase, into concrete with bluestone or granite aggregate, and then granite itself, hammer bits are required.

Once the bit is chosen, next we must select the proper type and kind of power driver. If a rotary bit is to be used, we must then know the bit size, and what speed electric drill to use, as well as the pressure to apply. If a hammer bit is to be used, we need to know the power size of electric hammer needed for that bit diameter.

Figure 3 shows respectively the commercial sizes of electric rotary drills to use for each hole size, the kind of material to be drilled, along with the pressure to apply for that problem. With hammer bits, the bit diameter determines the power size of the electric hammer to be used. The material, if in the hammer bit range, has no real influence on the hammer size to be used.

Considering the rotary bit again, Fig. 3 is a typical application chart for selecting the proper size electric rotary drill rpm and pressure to apply on core type rotary bits.

Further, in using a rotary bit, when pressures above 150 lb have to be applied, a rig is generally used. One man alone can apply about 90 lb for quite some time. About 75 lb per man, without a rig, is the safest way to figure pressure which can be exerted by a two-man team.

* Executive Vice-President and † Development Engineer, New England Carbide Tool Co., Inc.

Table 1. Rates of penetration in different materials for rotary and hammer bits

Material	Rotary Bit Diam	Electric Drill	Rate of Penetration
Soft Concrete	¼" Pointed	½" Drill 550 RPM	4.5" per min.
White Marble	¼" Pointed	½" Drill 550 RPM	2.4" per min.
Limestone	¼" Pointed	½" Drill 550 RPM	1.8" per min.
Hard Sandstone	¼" Pointed	½" Drill 550 RPM	5.0" per min.
Vitreous Tile	¼" Pointed	½" Drill 550 RPM	2.7" per min.
Soft Concrete	1½" Core-type	½" Drill 550 RPM	1.7" per min.
Hard Concrete	1½" Core-type	½" Drill 550 RPM	4" per min.
Material	**Hammer Bit Diam**	**Hammer**	**Rate of Penetration**
Soft Concrete	½" Pointed	1⅛ B & D	4" per min.
Hard Concrete	½" Pointed	1⅛ B & D	2⅞" per min.
Granite	½" Pointed	1⅛ B & D	2⅛" per min.
Hard Sandstone	⅜" Pointed	Syntron 10 RO	1½" per min.
Green Marble	⅜" Pointed	Syntron 10 RO	1½" per min.
Blue Pearl Granite	⅜" Pointed	Syntron 10 RO	1¼" per min.
Terra Cotta	⅜" Pointed	Syntron 10 RO	6" per min.
Vitreous Tile	⅜" Pointed	Syntron 10 RO	2⅞" per min.

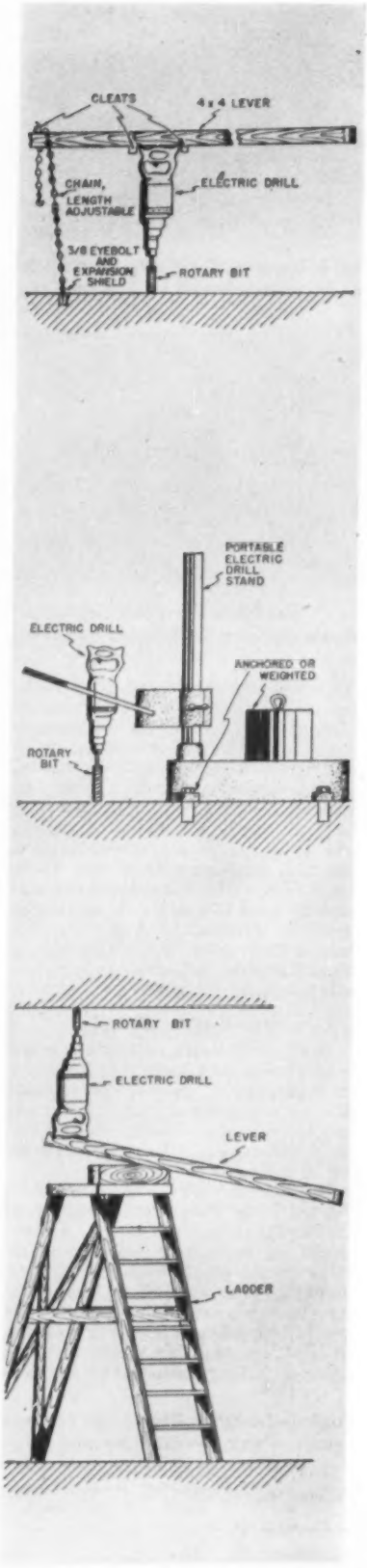


Fig. 1. Typical rigs for masonry drilling

Pressure rigs fall basically into three types. First, a rig in which reaction is taken up by bearing against the structural member of the building opposite the surface being drilled. An example is a floor to ceiling rig in floor or ceiling drilling.

Second, a rig in which the reaction is taken up by dead weight.

The third type of rig has the reaction taken up in or behind the surface being drilled.

Rigs which bear against an opposing member can only be used, of course, when that member is close enough, strong enough, and has an unfinished surface.

A weighted rig should be used only as a last resort, or when pressures are low. Weighted rigs, when used in conjunction with bits of large diameter ($2\frac{1}{2}$ in. and up), must weigh from 500 to 1000 lb. Naturally, this makes a very unwieldy piece of machinery.

An anchored rig can be very lightweight, and readily set up for either floor or wall drilling, but it is practical only when holes of diameter much larger than the anchor holes are to be drilled. Figure 1 shows some simple rigs of these types.

Some data with specific bits in particular materials is indicated in Table I. Information in this table is, of course, very specific, and its application to predicting rates of penetration and tool life on any other job depends entirely on the similarity of the material and bits used.

From the selector chart it can be seen that there is a common range of materials in 2 in. hole sizes and above for which either bit can be used. The five following points indicate the advantages of each.

1. The rate of penetration of the hammer core is less than the rotary.
2. The noise of the hammer in operation is generally less pleasant than that of a rotary drill.
3. The rotary bits in these larger diameters require rigging to apply pressure whereas the hammer core bits do not.
4. Applying pressure when drilling horizontal holes is generally very difficult with the rotary bits, unless an opposing wall or column is conveniently close. No rigging is needed for hammer core bits.
5. Bit life of the hammer core bits is much greater than the rotary.

In the materials on the border or those definitely out of rotary bit range, hammer bits should be used exclusively for worth-while results.

You should have these charts for future use. For full size charts and a copy of this article write to the Editor, or use one of the prepaid postcards elsewhere in this issue. Just write MASONRY DRILLING on the card and mail it to us.

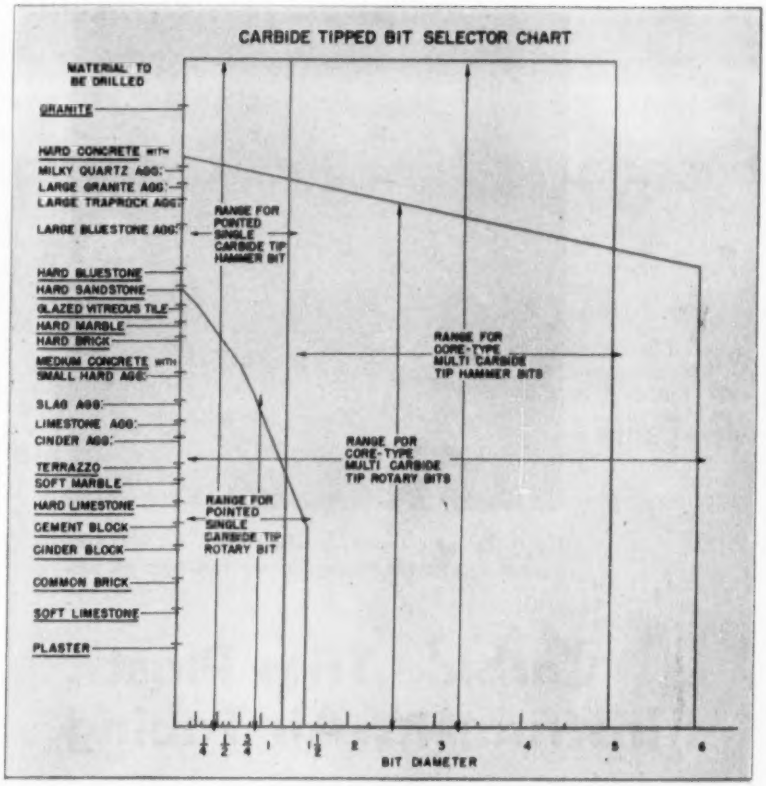


Fig. 2. Bit selector chart shows type of bit most suitable for various materials

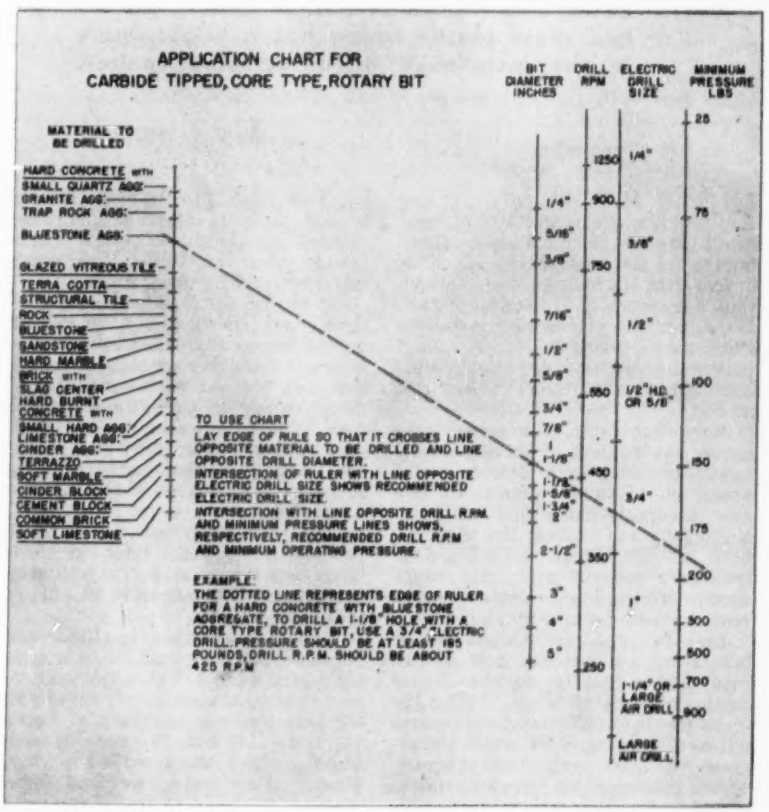

APPLICATION CHART FOR CARBIDE TIPPED, CORE TYPE, ROTARY BIT
BIT DIAMETER INCHES
DRILL RPM
ELECTRIC DRILL SIZE
MINIMUM PRESSURE LBS
MATERIAL TO BE DRILLED
HARD CONCRETE WITH SMALL QUARTZ AGG.
GRANITE AGG.
TRAP ROCK AGG.
BLUESTONE AGG.
GLAZED VITREOUS TILE
TERRA COTTA
STRUCTURAL TILE
ROCK
BLUESTONE
SANDSTONE
HARD MARBLE
BRICK WITH SLAG CENTER
HARD BURNT
CONCRETE WITH SMALL HARD AGG.
LIMESTONE AGG.
CINDER AGG.
TERRAZZO
SOFT MARBLE
CINDER BLOCK
CEMENT BLOCK
COMMON BRICK
SOFT LIMESTONE
TO USE CHART
LAY EDGE OF RULE SO THAT IT CROSSES LINE OPPOSITE MATERIAL TO BE DRILLED AND LINE OPPOSITE DRILL DIAMETER.
INTERSECTION OF RULER WITH LINE OPPOSITE ELECTRIC DRILL SIZE SHOWS RECOMMENDED ELECTRIC DRILL SIZE.
INTERSECTION WITH LINE OPPOSITE DRILL R.P.M. AND MINIMUM PRESSURE LINES SHOWS, RESPECTIVELY, RECOMMENDED DRILL R.P.M. AND MINIMUM OPERATING PRESSURE.
EXAMPLE:
THE DOTTED LINE REPRESENTS EDGE OF RULER FOR A HARD CONCRETE WITH BLUESTONE AGGREGATE. TO DRILL A 1-1/8" HOLE WITH A CORE TYPE ROTARY BIT, USE A 3/4" ELECTRIC DRILL. PRESSURE SHOULD BE AT LEAST 185 POUNDS, DRILL R.P.M. SHOULD BE ABOUT 425 R.P.M.
1/4" 5/16" 3/8" 7/16" 1/2" 5/8" 3/4" 7/8" 1" 1-1/8" 1-1/4" 1-3/8" 1-5/8" 2" 2-1/2" 3" 4" 5"
1250 900 750 550 450 350 250
1/4" 3/8" 1/2" 1/2" HD. OR 5/8" 3/4" 1" 1-1/4" OR LARGE AIR DRILL LARGE AIR DRILL
25 75 100 150 175 200 300 500 700 900

Fig. 3. Application chart gives bit size, drill size and speed, and min pressure

Fig. 1. Telephone wires in tube bundle aid in checking out and troubleshooting the instrument air services

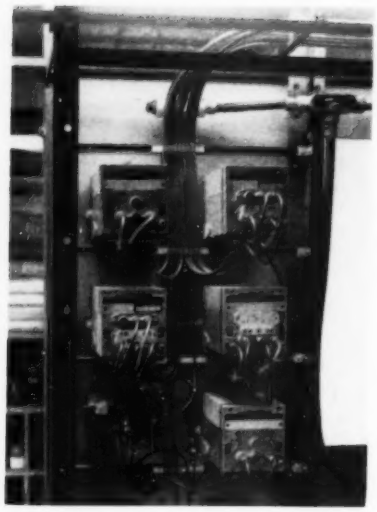


Fig. 2. Color-coded polyethylene tubing installed in an experimental test panel

Carbide Tries Plastic Instrument-Air Tubing

Small polyethylene tubing proved itself equal to many metal tube characteristics, superior to some, and slightly inferior to others. The totals show plastic tubing has a bright future in the installation of air-actuated controls

By E. I. THOMAS*

IN THE MIDDLE 40's we had a problem. Corrosive atmospheric conditions in a chemical plant caused failure of the instrument air lines in less than six months, even though they were made of 316 stainless steel. We solved the problem by installing steel tubing with a $\frac{1}{16}$-in. vinyl plastic coating extruded on the outside. Eight years later, it was still intact.

Somewhat later, the same technique was applied in solving a corrosion problem with flexible metal armor on thermal systems. In this case, accumulations of materials (including fly ash) within the convolutions of the armor would gather moisture, become acid, and cause system failure. Plastic protection has reduced these failures by 90 per cent.

Late in 1945, we started a new laboratory to evaluate new instrument items and to develop better methods to install them. Piping the instruments for different tests became a time consuming chore which threatened to bog down the program. Fabric reinforced air lines with quick-disconnects were tried, but were found unsuitable. Polyethylene tubing was found to be the answer to our problem after we had developed a suitable fitting. These fittings and the tubing are being manufactured by other firms.

On one of our first plant installations, two identical control panels were changed at the last minute and a new tubing layout was required. One was repiped with conventional metal tubing in three days by two men. The other was repiped with polyethylene tubing in less than one hour by one man, allowing start-up to be moved ahead by two days. Labor costs for the metal tubing installation were about $2.10 per foot. Two years later, in 1954, labor cost for installing polyethylene tubing were determined at $0.145 per foot.

At our suggestion in 1952, our supplier manufactured for us a multiple-tube bundle. The intention here was to reduce installation times still further. Various numbers of tubes (4, 7, 10, 14, and 19) were in each bundle, which was sheathed in vinyl plastic. Previously, we had been making up bundles by wrapping a number of single tubes with electrician's tape, thereby improving appearance, identification and support.

Paired telephone wire can be added in the manufactured bundles (10, 14 and 19 tube bundles) so that sound-powered telephones can be used in checking out the original installation and in subsequent troubleshooting. Junction boxes are used when tubes branch off, and these boxes contain jacks for the connection of sound-powered telephones. Fig. 1 shows one such installation.

Since polyethylene burns like a candle, it is natural that our Process Safety and Fire Protection Department showed concern at our increasing use of the tubing. Three separate and extensive fire tests were made as a result. The first test called for exposing both polyethylene and various metal tubes over a gasoline fire while under the "protection" of a water spray. This test proved that water sprays did not provide adequate protection for the tubing. Both polyethylene and aluminum tubing failed under the intense heat, and scale capable of immobilizing instruments developed in the metallic tubes.

Second tests called for protecting the plastic single tube and multitube cable in uninsulated and insulated conduit. Inside an insulated conduit, a single tube failed in 1 minute and 40 seconds, while the 10-tube cable in the same conduit at the same time had no failures until it had been exposed 20 minutes and 40 seconds. The single tube failure was traced to mechanical damage to the insulation where it rested on the edges of the fire pan.

Our tests lead us to the conclusion that any duct of equal fire resistance

*Chief Instrumentation Engineer, Instrument Division, Carbide and Carbon Chemicals Company.

to insulated iron conduit would provide not only adequate protection for multiconductor, vinyl-sheathed polyethylene tubing, but would afford longer instrument service during fire exposure than would be obtained with exposed metal tubing. Also, the tests proved that vinyl-sheathed multitube cable should be used instead of single strand tubing.

Tests were also conducted to determine the bursting pressure vs temperature characteristic between the operating temperatures minus 20 F and 175 F. At a temperature of minus $12\frac{1}{2}$ F, the tubing did not burst at 600 psig. At 175 F, bursting pressure was 90 psig. We considered this an adequate margin of safety since the normal instrument air service is 20 psig.

Speed of response to signals is extremely important to many installations so tests were conducted to compare copper tubing with polyethylene tubing in this respect. Tests showed that 50 cu ft per hr flowing through $\frac{1}{4}$-in. OD, 0.030-in. wall copper tubing dropped 4 psi per 100 ft. Polyethylene tubing ($\frac{1}{4}$-in. OD and 0.040-in. wall) showed a drop of 6.25 psi per 100 ft. Polyethylene tube with 0.062-in. wall and $\frac{1}{4}$-in. OD showed a drop of 21.5 psi in 96 ft.

Oscillatory signals transmitted through the copper and the $\frac{1}{4}$ by 0.040-in. plastic tubing were compared for distortion and loss of amplitude in different length lines. For frequencies of 10 cycles per minute (sinusoidal, 9 ± 3 psi) and above, no significant differences were observed. It seems possible that there would be no difference in response between the two if the copper tubing had been older and somewhat tarnished. Observations did show that polyethylene tubing phase lag (in degrees) was greater than it was in copper.

One of the curves plotted in this test is shown in Fig. 3, which establishes transmission quality by comparing the maximum length of the tubes compatible with a given (95 per cent) amplitude ratio as the frequency of signals is increased. Quality transmission is defined as no more than 5 per cent change in fundamental amplitude, or more than plus or minus 30 degrees phase shift — whichever is the more stringent. Fig. 3 shows that polyethylene has a slightly lower transmission quality than copper tubing of the same length. We now plan more work in this field to obtain more accurate data over a wider variation of frequency ranges.

Table I compares materials costs per 100 ft of aluminum, copper and polyethylene tubing purchased in 5000-ft lots — bundled into cables or equivalents in footage of single strand. It should be noted that prices for copper tubing were in effect in August, 1953; those quoted for polyethylene were for January, 1953. The price advantage in plastic's favor is clearly shown, and the installation costs given earlier showed $0.145 to $2.10 per ft in polyethylene's favor. Table II shows some of the factors which make polyethylene easier to install and support.

Summary

Advantages of polyethylene tubing over various metal tubings are as follows:

1. Using the multitube cable, it decreases installation time and labor costs and provides a more flexible installation of instrument air supply.
2. It can be installed as wire cable from one support bracket to another, in expanded metal trays, in trenches, buried, or run into conduit.
3. Insulated conduit used as a support for multitube cable will give longer instrument service than can be expected from exposed metal tubing during exposures to the same fire.
4. Longer lengths can be installed than is possible with metal, thus eliminating joints. It is also lighter to handle and can be installed with smaller radius bends.
5. The use of vinyl sheath increases resistance to wear and abrasion, and affords additional fire protection.
6. It decreases the cost of tubing maintenance since the only tools needed to install or repair it are a sharp knife, a 6-in. Crescent wrench to install tube adapters, and a good thumb and forefinger to make the fittings finger-tight.
7. Exposed polyethylene is resistant to most chemical corrosion.
8. Sound-powered telephone wires within the cable will aid in expediting instrument checking during the years following the installation.

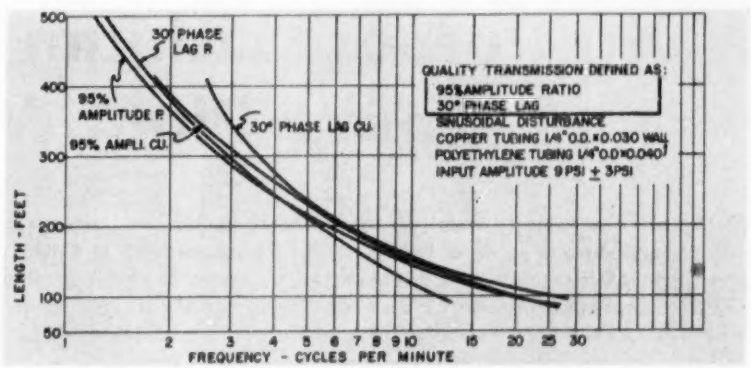


Fig. 3. Comparison of lengths compatible with quality transmission vs signal cpm

Table I. Cost comparisons between plastic and metal tubings (cable and single)

Number Tubes per Bundle	Price per 100 Ft (5,000-Ft Lots)			Price for Equivalent Footage		
	¼" O.D. Copper 0.030" Wall 8/53 (A)	¼" O.D. Aluminum 0.032" Wall (A)	¼" O.D. Polyethylene 0.040" Wall 1/53*	¼" O.D. Single Tube Copper 0.030" Wall	¼" O.D. Aluminum 0.030" Wall	¼" O.D. Polyethylene 0.040" Wall
4	$ 87.60	$ 65.00	$29.44	$ 28.00	$16.00	$16.00
7	126.50	92.40	46.60	49.00	28.00	28.00
8	143.50	104.00	—	56.00	32.00	32.00
10	179.00	127.30	60.29	70.00	40.00	40.00
12	205.00	143.00	—	84.00	48.00	48.00
14	—	—	74.73	98.00	56.00	56.00
19	309.00	214.00	90.98	133.00	76.00	76.00

* Telephone wires add $3.00/100 ft for 10, 14, and 19-tube cables.
(A) Flexible galvanized armor over all.

Table II. Installation characteristics of metal versus plastic tubings (cables only)

Number Tubes per Bundle	Weight per 100 Ft in Pounds			Bending Radius, in Inches		Approximate O.D. Inches	
	Copper	Aluminum	Polyethylene	Metal	Plastic	Metal	Plastic
4	66	44	9	2.5	1.5	.83	13/16 x 5/8
7	97	58	16	3.3	2	.96	13/16 x 5/8
8	110	66	—	3.5	—	1.06	—
10	133	77	20.6	4.5	2.5	1.21	13/16 x 1 1/8
12	152	84	—	5	—	1.25	—
14	—	—	25	—	3	—	1 1/4 x 1 1/8
19	220	113	30.4	8	3.5	1.46	1 1/4 x 1 3/8

Fig. 1. Lithium grease is applied to coal conveyor bearings

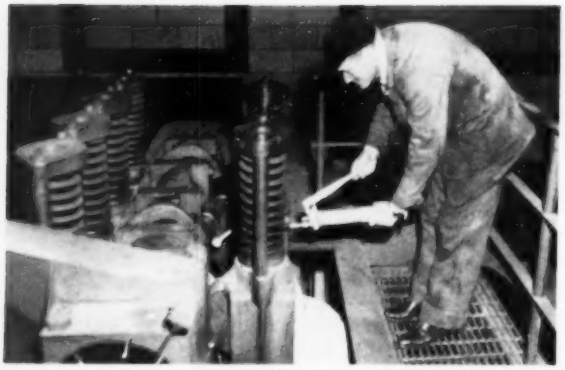


Fig. 2. Same grease used to service turbine admission valves

Multi-Purpose Lithium Grease Cuts Power Plant Maintenance

Although the introduction of multi-purpose lithium grease into the field of industrial lubrication is a fairly recent development, a three-year trial of this new type of lubricant at Consolidated Edison's East River plant extension has already demonstrated that it can replace a variety of special-purpose lubricants with very satisfactory results. In addition to the economies to be realized from use of a single grease, safer and more positive lubrication should be achieved

By G. H. LINK*

FROM THE TIME coal is delivered to various boilers on belt conveyors, to the moment when ashes are sluiced out of the plant through 20 ash gates, a lithium-base multi-purpose grease helps produce megawatts at Consolidated Edison's East River plant extension. In addition to these two uses — conveyors and ash gates — the same grease is applied throughout the plant to meet a wide variety of lubrication requirements. In fact, lithium grease is the only type of grease being used in the new extension and it services all plant equipment and machinery except those applications which specifically require a lubricating oil.

East River extension is actually an addition to a generating station already in existence, but it is, in effect, an entirely new and independent plant even though steam connections, coal conveyor belts, and electrical connections tie it to the original plant. The new plant had no operating history on which to predicate a choice of lubricants, but Con Edison engineers did have a wealth of records from many other plants to guide them. This experience led them to believe that the East River extension should be the testing ground where they would first assess the merits of using a single multi-purpose grease for all manner of grease applications.

The advantages of using a single multi-purpose grease in place of a number of specialized greases were considered to be eight in number:

1. To reduce the number of grease guns, drums, containers, and total lubricant storage area;
2. To reduce cost by purchasing a single item in large quantities instead of many items in smaller quantities;
3. To simplify bookkeeping and inventory control;
4. To reduce lubrication time; applying same grease at each lubrication point requires less effort, lessens chance of overlooking fittings;
5. To achieve safer and more sure lubrication. Operator cannot erroneously apply a water-resistant (calcium-base) grease where a high-temperature (sodium-base) grease is needed. Lithium-base grease combines both properties;
6. To simplify training of lubrication personnel;
7. To lengthen intervals between relubrication;
8. To reduce grease consumption and waste.

Practically every application of the multi-purpose grease in the East River plant can be encountered by following the path of coal as it travels through the station. The path begins at the coal conveyor, which consists of three sections — each 48 inches wide and approximately 230 ft long. Idler pulleys supporting the belts revolve at approximately 300 rpm, and are gun-lubricated with grease once every six months. This grease not only provides safe lubrication but also acts as a sealing agent to keep abrasive coal dust out of the pulley bearings.

Each coal feeder, as well as the 2-hp motor which drives it, is also lubricated once every six months with the same grease. Because overgreasing does more harm than good, the motor has a sealed fitting to keep well-meaning oilers from greasing it every time they pass by. Coal feeders supply coal to eight Babcock & Wilcox ball mills which in turn deliver powdered coal to two high-pressure boilers.

Four pulverizer mills connected to each boiler permits the uninterrupted generation of more than a million pounds of superheated (1500

* Lubrication Engineer, Shell Oil Co.

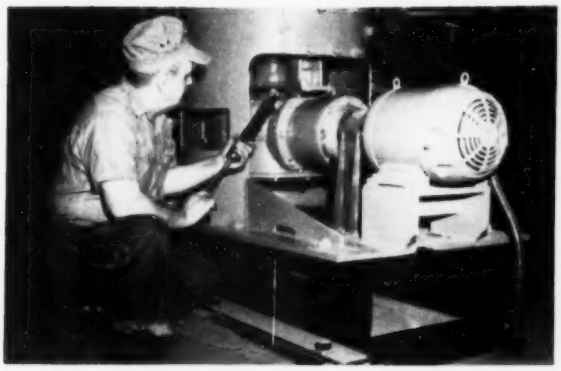


Fig. 3. Coal feeder and its drive motor serviced by same gun

Fig. 4. Turbine bed plates pose problem of sliding friction

Fig. 5. Valve controlling travel of ash gate gets attention

Fig. 6. Motor and chemical pump all one job to new lubricant

psi, 1000 F) steam in each unit. Each boiler is individually connected to a General Electric cross-compound turbine, with double-flow exhaust on the low pressure element and a single condenser. Each unit has a rated capacity of 137,000 kw.

Normally, one would think only of oil in connection with turbine lubrication. However, greases are used in a few instances, and Consolidated Edison employs lithium grease for two such turbine applications. The first is at the admission valves to the steam chest. Cams of these valves, which are usually quite hot, are checked once a week; if necessary, additional grease is forced in with a gun.

The second application of the lithium-base grease is found at the base of the governor, between the pedestal and the turbine bed plates. Here a slip joint permits lateral movement of the turbine with respect to the foundation in order to take care of thermal expansion and contraction. Button fittings all around the governor base simplify the introduction of lubricating grease at regular intervals.

Steam is extracted from the turbines at several stages to heat feedwater. Valves on these bleed steam lines are greased once every month.

The East River extension uses a multitude of electric motors to drive various auxiliaries. Many of these motors, too, are periodically lubricated with the same lithium-base grease.

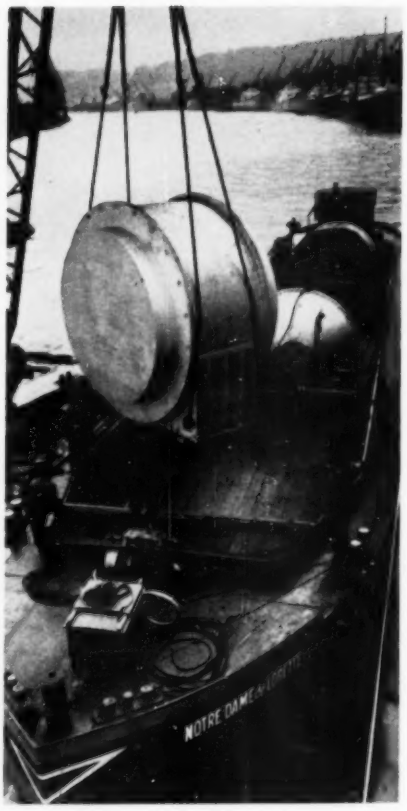
The coal reaches the end of the line after turning to ashes. Both high-pressure boilers have ten ash dumps, with two gates at each dump. The upper gate is opened, the hot ashes allowed to drop into the hopper, and the upper gate closed again. Next, ashes are quenched with salt water from the East River, the lower gate is opened, and the cooled ashes dropped into waiting disposal trucks. Multi-purpose grease helps to keep the ash gates functioning, despite the heat and moisture present.

It is now only some three years since the East River extension was started up, and a lithium-base grease supplied by Shell Oil Company has been used exclusively during this critical breaking-in period. Although the Consolidated Edison Company considers three years hardly enough time, as power plants go, to justify positive conclusions, the operators do agree that this multi-purpose grease has proven entirely satisfactory under all conditions encountered. Of special interest is the fact that this single grease replaced the many found in the equipment as originally installed, which sheds considerable light on the question of "compatibility." It has often been believed that the mixing of two greases of different composition may cause an undesirable interaction to take place. In this instance, even though lithium grease replaced more than half-a-dozen various lubricants, and did so without prior dismantling or degreasing of equipment, no signs of incompatibility were noted.

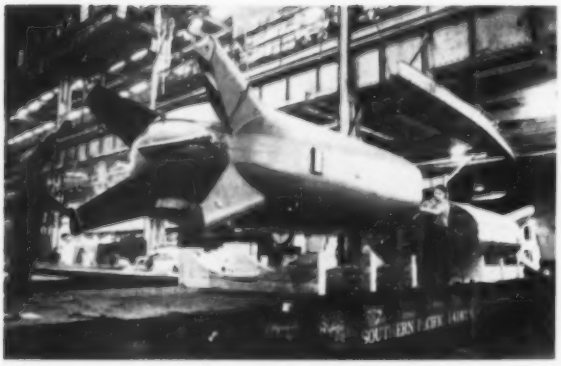
Typical Lithium Grease Specifications

Color	light amber
Texture	smooth
Soap (kind)	lithium
Soap (percentage)	7–9
Dropping point ASTM (deg F)	360 minimum
Mineral oil (kind)	solvent coastal
Mineral oil (SUS at 100 F)	475–525
Consistency ASTM	
unworked	288
worked 60 strokes	275
worked 180 strokes	272
worked 300 strokes	270
worked 10,000 strokes	290
worked 100,000 strokes	295
worked 1,000,000 strokes	322
Oxidation bomb test (psi drop 100 hr)	5 maximum

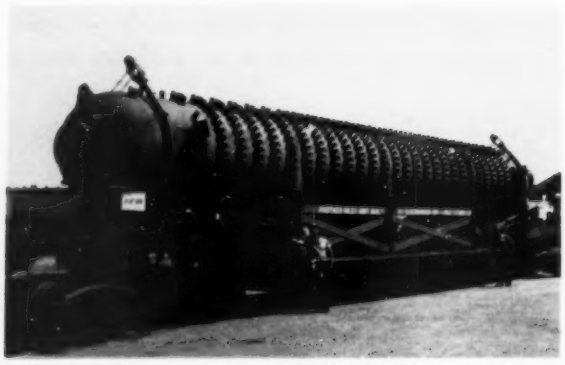
Power Engineering's NEWS REEL



This 60,000-kva synchronous condenser is unloaded from the S.S. Jessie Maersk at Rouen, France, for transshipment up the Seine by barge. It is the second such machine purchased from Westinghouse by Electricite de France. Installation was completed in a record 57 days at the Harcourt substation, including reassembly of the 545,000 lb of parts disassembled to expedite its shipment

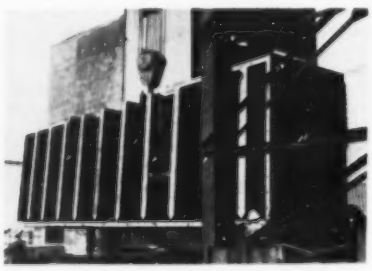


Though it looks ready to take off for Mars, this 25 million kva-interrupting circuit breaker tank is just going to the AEC plant in Ohio as part of Westinghouse's 35-unit quota



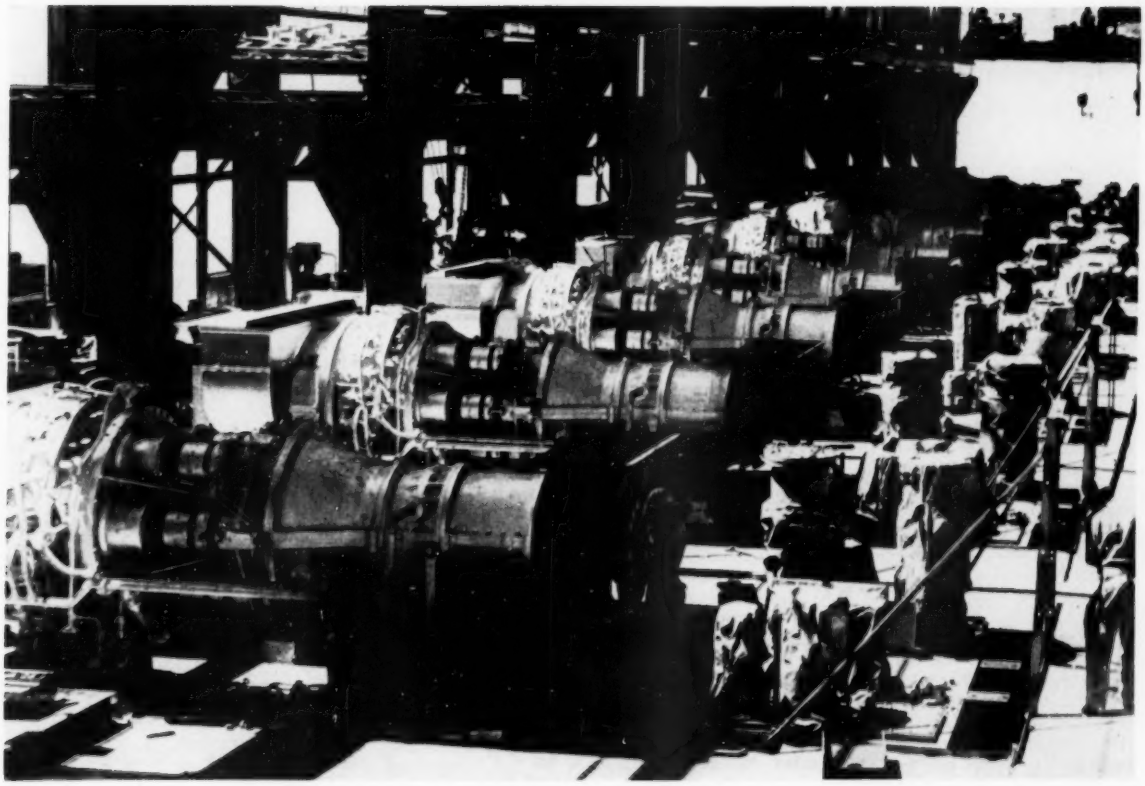
Los Angeles Water and Power Department was on the receiving end of this 127-ton Riley boiler drum. It will be in one of two 1,200,000 lb per hr units, 2115 psi, 1000 F

J-M's new inertia type dynamometer is largest and most versatile ever built

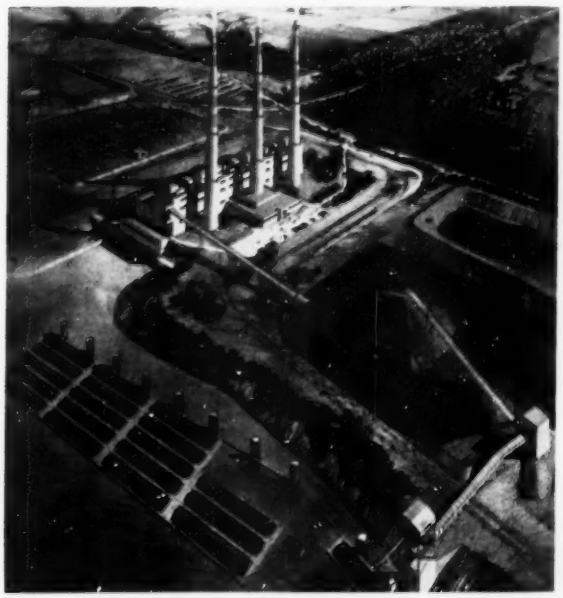


Foster-Wheeler turbine-supporting condenser goes up at Rockland L & P

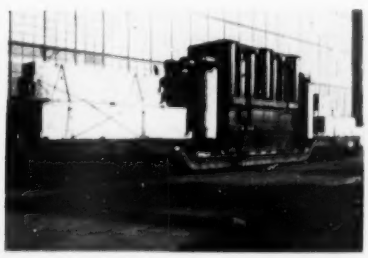
Computer will figure delivered power cost for the Southern Co., Birmingham



Ten 6,000-hp gas turbines (GE) will drive compressors to force natural gas extracted from oil back into the ground at Creole Petroleum Corporation's Lake Maracaibo, Venezuela, installation. This maneuver will maintain subterranean gas pressures high enough to force oil to the surface without pumping, will conserve natural gas, and maintain low oil viscosity

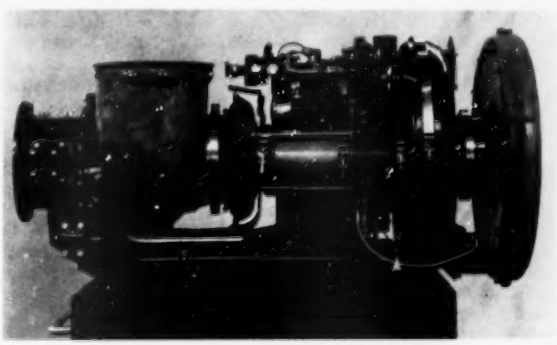


Architect's sketch of enormous new Clifty Creek plant near Madison, Indiana, which will generate 1,200,000 kw for the AEC when completed in 1956. Another plant, near Gallipolis, Ohio, will have original capacity of 1,000,000 kw. Both will transmit to Portsmouth, Ohio, over double circuits at 330 kv. Plants are owned by Ohio Valley Electric Corporation, comprised of fifteen privately-owned utility companies



GE transformer designed to fit on car. Minimum disassembly speeds erection

New Boeing gas turbine has separate compressor and power turbines, output of 240/270 hp, weighs 320 lb complete, and has lowered fuel consumption 25% (below)



Paul J. Grogan's* Graphical Solutions for Power Engineers

Figuring Air Horsepower

(Graph on page 79)

CALCULATION of air (and fan drive) horsepower becomes relatively simple once the basic assumption is made that air is not appreciably compressed as it passes through a fan. The calculations are further simplified by the use of graphical techniques, such as those presented here.

Air horsepower may be expressed as a function of cfm or lb per min of air being "pumped" against a back pressure expressed in lb per sq ft, inches H_2O, or feet of air. The graphical analysis presented here is based on cfm against a head expressed in inches H_2O.

$$AHP = \frac{5.2(CFM)(\text{Inches } H_2O)}{33{,}000}$$

Combined efficiency of the fan and drive is added to the denominator to yield the horsepower input if this is calculated mathematically, but is considered separately in the graph. Air temperature does not enter the calculation since the equation used considers the air volume being moved, which itself is a function of the temperature.

Graphical solutions are quickly obtained by application of the chart.

EXAMPLE: Assume a problem involving the movement of 7,000 cfm of free air against a pressure of 6 inches H_2O. Assume the combined efficiency of the fan and motor to be 60 per cent. Solve for the air horsepower by projecting a line (A) from 7,000 cfm to intersect 6 in. H_2O on the diagonal pressure rise scale. Project line (B) directly to the air horsepower scale. Line (B) intersects at about 6.6 hp, which is the answer.

Horsepower input, however, must consider the combined efficiency of the fan and drive. This is found by projecting line (C) from the intersection of lines (A) and (B) to intersect the line designating 60 per cent efficiency. From this intersection, project line (D) directly to the horsepower input scale for an answer of 11 hp (required power input).

If the original data were expressed as 420,000 cfh rather than in cfm, it would be necessary first to project a line (A′) to intersect the conversion line, then project a second line (AA′) horizontally to intersect the pressure rise line. From this second point of intersection, the solution would be the same.

Direct conversion of cfm to cu ft per hr can be accomplished easily by projecting a line directly from the cfm scale to the conversion line, then to the cu ft per hr scale (lines E and F). Normally, of course, these conversions are done mentally. Approximate conversions of cfm to lb per min can be accomplished by applying the following equation:

$$w = \frac{39.7 \times \text{cfm}}{(\text{deg F} + 460)}$$

This equation is derived from the relationship $pv = wRT$, and assumes 14.7-psia air with a gas constant $R = 53.3$.

Figuring Water Horsepower

(Graph on page 80)

CALCULATION of water (and pump drive) horsepower is similar to the calculation of air horsepower in that both involve moving a mass against a backpressure and both assume incompressibility. These calculations also can be reduced to a graphical form to simplify their use.

In this instance, calculations are based on the gpm displacement of and pressure rise through the pump. Since the gallon is a fixed volume unit (231 cu in.), the gpm × pressure rise product is directly proportional to water horsepower. The relationship is given in the following equation:

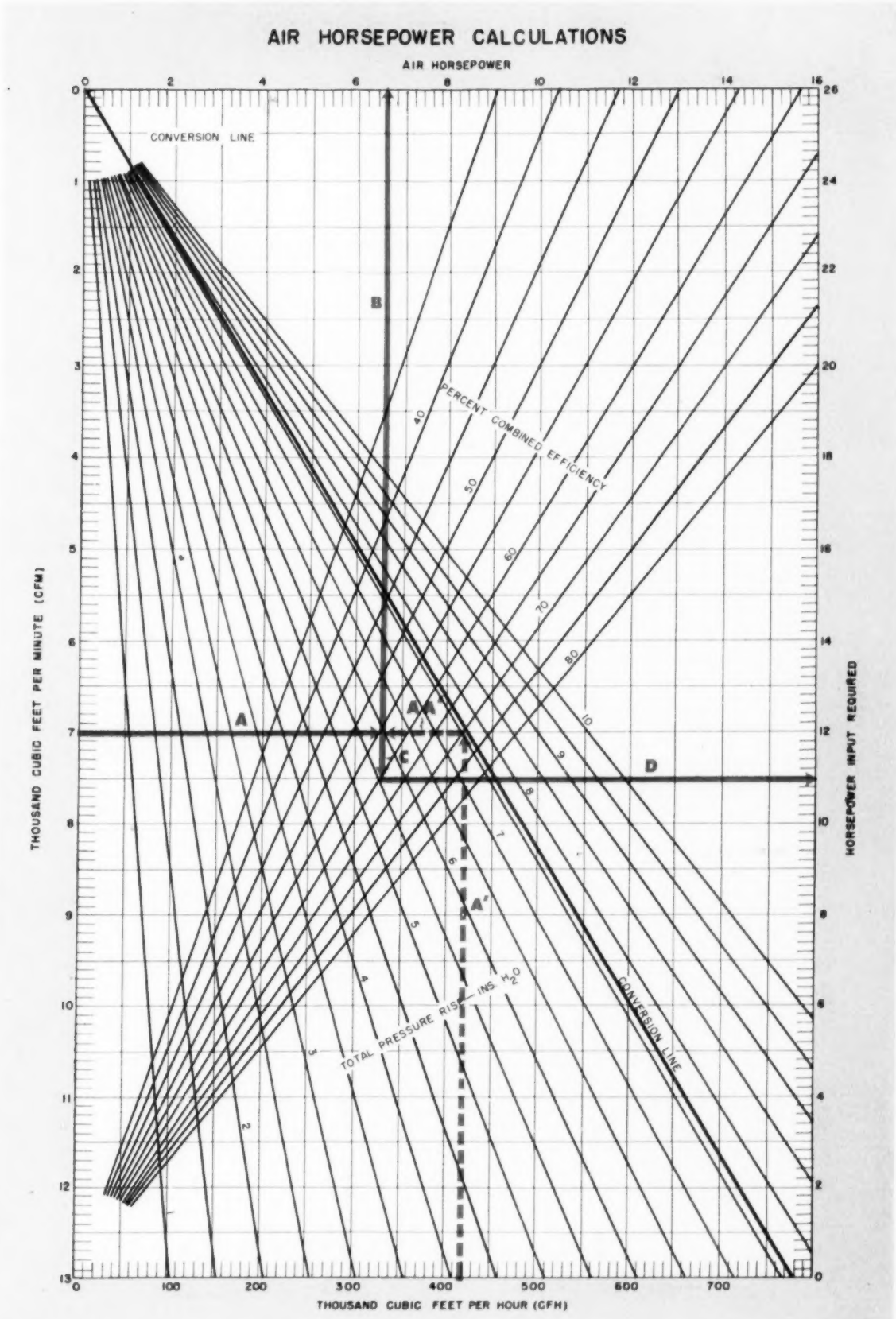
$$WHP = \frac{231(GPM)144\Delta p}{1728 \times 33{,}000} = \frac{7(GPM)\Delta p}{12{,}000}$$

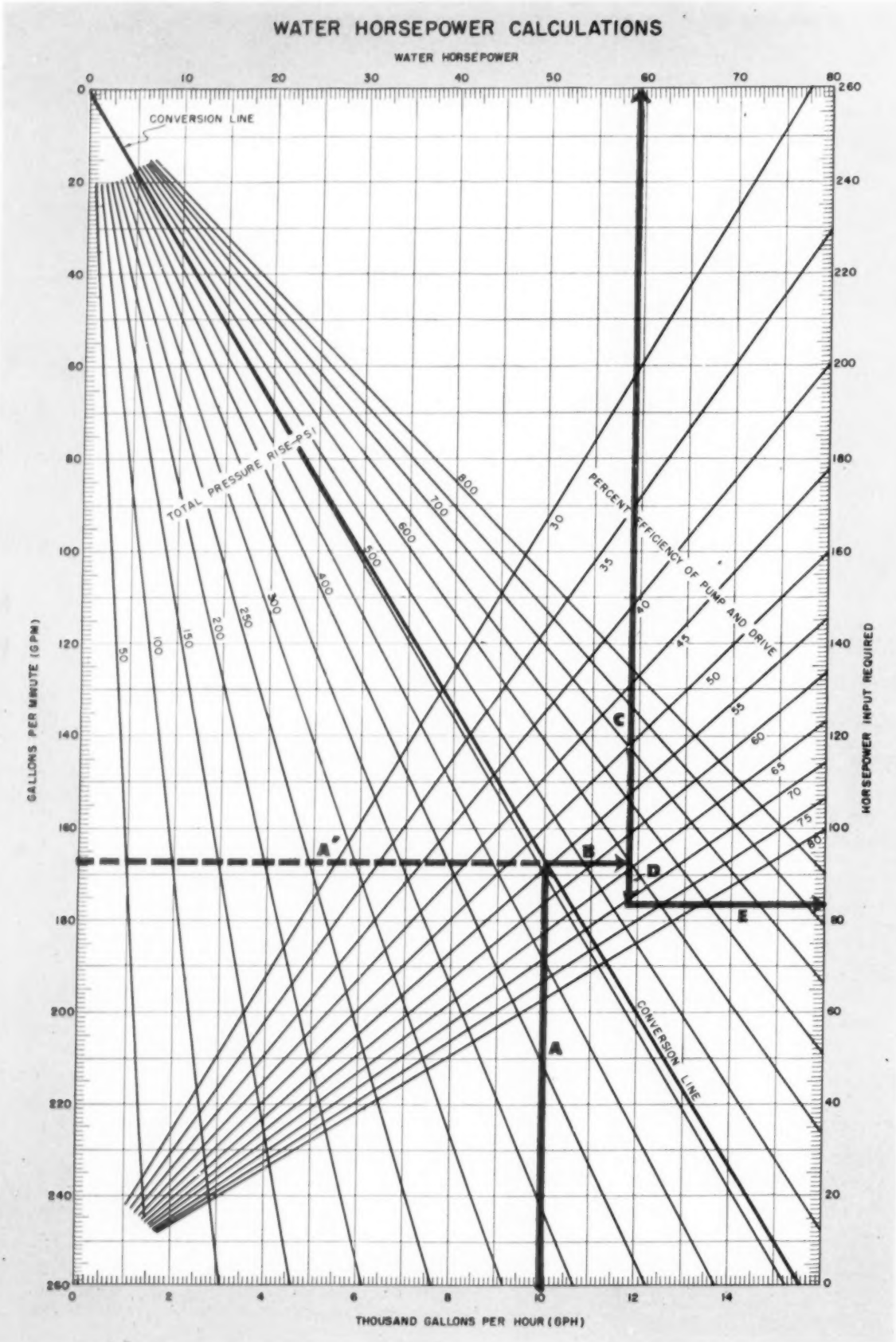
Again, the combined efficiency of the pump and drive would be added to the denominator if the problem were solved mathematically for required motor horsepower, but is considered separately in the graphical form. One thing to keep in mind when making pump calculations is that, for a given pump and motor, a change in the pumping rate and/or pressure usually entails a change in efficiency for both the pump and the motor. Well-mated pump and drive combinations will peak with fairly flat efficiency curves near the point of full pump load. Another point to remember is that the combined efficiency of the two units is the product obtained by multiplying one efficiency by the other.

EXAMPLE: Assume a problem involving the movement of 10,000 gallons of water per hour. Inlet pressure is 50 psia and outlet pressure is 650 psia; combined efficiency of the pump and drive is 70 per cent. Solve for the water horsepower by projecting a line (A) from 10,000 gph on the bottom scale vertically to the conversion line. From the point of intersection, project a line (B) horizontally to intersect the 600-psi pressure rise line. From this intersection, project a line (C) vertically to intersect the air horsepower scale. Line (C) intersects at about 59 hp, which is the answer. Horsepower input, however, must consider the combined efficiency of pump and drive. This is accommodated by projecting a line (D) from the intersection of line (B) with the 600-psi line downward to the 70 per cent efficiency line, and projecting a line (E) horizontally to intersect the power input scale. This intersection is at approximately 84 hp (required power input).

If the pumping rate were given in gpm rather than in gph, line (B) would not have been required, since it would have been a straight continuation of line (A) to intersection with the pressure rise line. Such a solution is shown by line (A′), which is projected from 167 gpm (10,000 gph equivalent) directly to the 600 psi line. The balance of the solution remains the same. The conversion line can be used to convert gpm to gph or vice versa, but this operation is normally done mentally.

* Chairman, Department of Engineering, and Director of Engineering Institutes, University Extension Division, University of Wisconsin. All republication rights reserved by author.


AIR HORSEPOWER CALCULATIONS
AIR HORSEPOWER
CONVERSION LINE
40 PERCENT COMBINED EFFICIENCY
50
60
70
80
A
B
C
D
AA'
A'
THOUSAND CUBIC FEET PER MINUTE (CFM)
HORSEPOWER INPUT REQUIRED
TOTAL PRESSURE RISE — INS. H2O
CONVERSION LINE
THOUSAND CUBIC FEET PER HOUR (CFH)


WATER HORSEPOWER CALCULATIONS
WATER HORSEPOWER
CONVERSION LINE
TOTAL PRESSURE RISE-PSI
800
700
600
500
400
300
250
200
150
100
50
PERCENT EFFICIENCY OF PUMP AND DRIVE
30
35
40
45
50
55
60
65
70
75
80
A'
B
C
D
E
A
CONVERSION LINE
GALLONS PER MINUTE (GPM)
HORSEPOWER INPUT REQUIRED
THOUSAND GALLONS PER HOUR (GPH)

It's the Man Behind the Camera that Counts

Most readers will be familiar with the excellent photographs taken by Mr. Riley to illustrate his ingenious machine shop methods. Here he explains how he gets his remarkable results

By F. E. RILEY*

MY WORKSHOP CAMERA outfit is largely homemade, mainly in the interests of economy. Some 30 years old, the camera is a Contessa Netall and was purchased second-hand for about $12.00. It is designed for glass plate negatives which are still used widely over here. Cut film is the same thing, of course, but the base material has to be imported so the price is higher. Film packs are now available but have never regained their pre-war popularity, mainly because of their high cost. The camera is of the drop-baseboard folding type with an f. 4.5 lens in an ordinary Compur-type shutter housing. Stops go down to f. 36, at which aperture all of my photographs are taken.

A close-up lens is fitted for most work and comprises a glass obtained from a pair of pre-war dime-store spectacles. This enables me to approach within 18 in. of an object, but as the camera has only single-extension bellows, this is not as close as I would like to approach in many cases.

The original dark slides provided with the camera were for negatives measuring approximately $3\frac{1}{2} \times 4\frac{3}{4}$, but these have been discarded in favor of standard 120 or 620 roll films. The film is housed in a holder fitted with a dark slide, and I used a homemade version for a number of years and wore it out. Now I have a very nice all-metal job which is made in Germany. The advantages of roll film can be obtained with such an arrangement, while focusing and composing the picture on a ground glass screen is also possible.

I think I am getting the maximum clarity of definition of which my lens is capable; this is only possible by careful lighting of the object to be photographed, correct exposure, and elimination of camera shake and tremors during exposure.

Two 500-watt filament lamps of the over-run type are used for lighting and these are mounted in homemade shades of stiff cardboard with reflecting surfaces painted with aluminum paint. Outsides of the shades are painted matt black to eliminate stray light reflection. I have recently adopted a lamp of the internal reflector type which eliminates bulky shades.

About glare! Most of this is caused by excessive contrast range in the subject, due to bad lighting and by over-exposure. If the intensity of lighting is fairly even over the subject area, glare ceases to be a problem.

The best way to get even lighting is to place one lamp immediately in front of the camera lens and shining on the object. Place the second lamp alongside the camera and pointing in the general direction of its line of sight. If there are any hot spots on the object, it will be due to the actual light bulb shining on a polished surface; this can be corrected by merely shifting the lamp an inch or so. There is no doubt that depth and clarity can be infused into the dullest picture by strong back lighting. I don't use diffusers.

Back lighting can only be used if the lens hood is efficient. Mine is about 3 in. deep because I find I can use this length without cutting off the corners of the picture. I would use a lens hood a foot long if it were possible. Mine is made from a plastic tumbler with the bottom cut off. I might mention that I have been able to light an object so evenly that the finished print has looked flat and dull. It is better to have one strong highlight and one deep shadow in a photograph to make it look interesting.

I take a meter reading of every set-up but find that exposures are standardized at 1 second at f. 36 with the lighting described. On a roll of film it is possible to give each negative the same exposure during printing on the enlarger and to obtain prints which range through from dead white to black, with decent-looking half tones between.

Camera shake is a greater menace to sharpness than most photographers realize My camera is mounted on a wooden folding tripod with metal struts joining the legs together, about half way up. A solid wooden tilting table mounting holds the camera. Camera height adjustment is by a steel pillar sliding vertically and locked in place by a substantial headed knob.

Example of sharp definition obtained with methods described in this article

A cable is not used to actuate the shutter, instead, a hydraulic delayed-action release trips the shutter after about 30 secs. The camera trip can be set and then any hands or persons needed in the picture can be placed. The camera man can thus act as his own model.

I never use flash in the workshop, mainly on the grounds of expense. But I don't see how the lighting can be arranged and the set-up shown to best advantage unless it is lighted properly while the photographer is viewing it through the camera screen. Most industrial photographers in this country avoid flash lighting. If there is any diffused daylight they will utilize this and be prepared to give exposures up to $1\frac{1}{2}$ minutes duration at apertures like f. 36. In very dull situations, a bulb may be fired in a

continued on page 126

* About the Author

Mr. Riley is an English free-lance designer and consultant. Most of his work is concerned with jig and tool design and consultation on manufacturing problems with small firms having no engineering staffs. He has also developed industrial photography as a sideline. Readers of his articles which have appeared in POWER ENGINEERING in recent years will no doubt have been impressed with his remarkable photos of close-up machine shop operations. He brings to the art of photography the same ingenuity and practical skill that make his machine shop articles so unusual and useful.

More on Noise Reduction

In June we described ways of reducing power plant noise. Here the author explains how to reduce chimney noise, discusses noise complaint costs, and reports recent court decisions

By W. F. FRIEND *

Figs. 1 and 2. Show two views of the installation of acoustical blankets for absorbing excess noise made by chimney

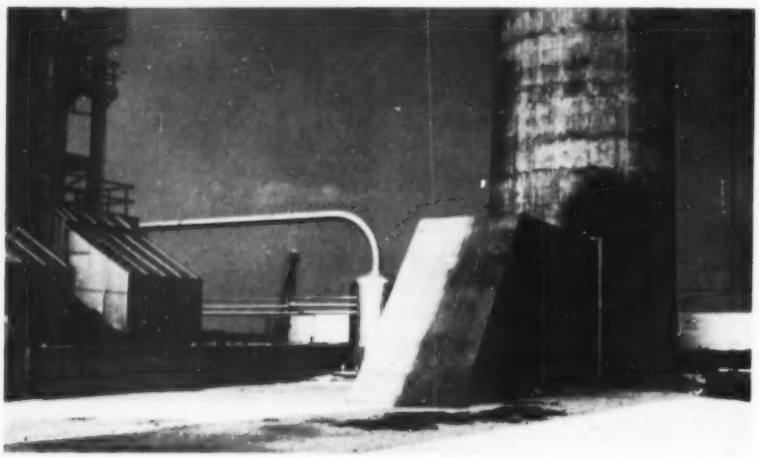


Fig. 3. Duct between fans and stack is run underground to reduce excess noise

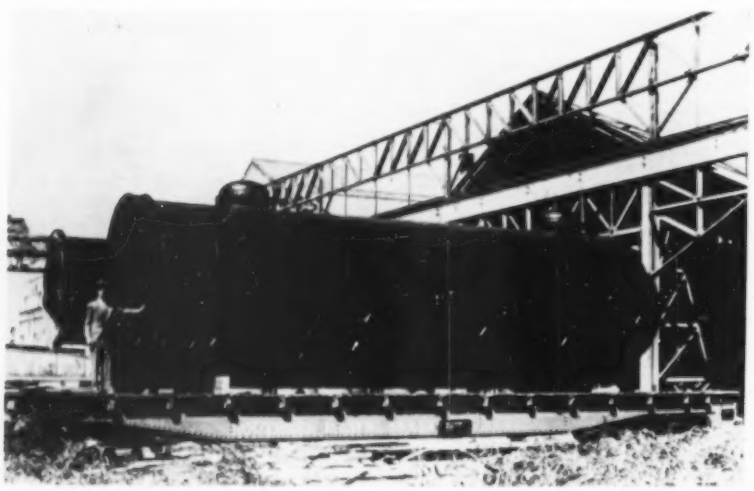


Fig. 4. Giant snubber for a cat cracker. Snubber is 41 ft long and weighs 34 tons

SOME YEARS AGO, disturbing noise came from a power station chimney situated close to residential and business areas of a large city, causing serious complaint throughout a half-mile radius. In this station, the original equipment had been replaced by a high-pressure installation, of which four induced-draft fans symmetrically placed at the upper level of the boiler-room structure discharged directly into openings around the base of a brick-lined steel chimney about 22 ft diam. A noise survey showed the pitch of the penetrating sound to be everywhere the same; it had a frequency in cycles per second corresponding to fan rotative speed multiplied by number of blades in the fan wheel.

The wheels, scroll casings, and discharge breeching connections were modified, but without benefit. Relocation of the fans elsewhere in the gas circuit was considered, but proved impracticable because of space limitations resulting from bulky flyash eliminators. Solution was found with acoustical "blankets" hung in the lower 50 ft of the stack, supporting them from a structural-steel grillage attached to interior of the chimney, as shown in Figs. 1 and 2. The blankets, made of woven glass-fibre cloth containing quilted acoustical felt, were fastened to lower face of the grillage in a pattern dividing the chimney cross-section into 3 ft squares. Amount of acoustical material, and the cross-section and length of the resulting square vertical tubes, were calculated to give sound attenuation of required decibel value at the distributing frequency.

Fan Noise

An instance of chimney noise concerned a new radial-brick stack about 14 ft diameter at the base, receiving flue gas from a single induced-draft fan equipped with inlet-box louver dampers operated by automatic combustion control. Fan was mounted within the concrete pedestal-type stack support and discharged vertically upward through a short "evase" extension duct between scroll outlet and a rectangular opening in the steel floor plate of the brick stack. When the 30,000 kw turbine-generator unit and its boiler went into operation, excessive noise was heard in the neighborhood coming from top of the stack. Spectrum analysis showed random frequencies in a range between 100 and 2000 cps. The particular frequencies corresponding to fan rotative speed and number of blades, or to harmonics of these values, were not evident.

Since the condition was critical, a number of changes were made in quick succession, leaving no opportunity for testing to ascertain how

* Mechanical Engineer, Ebasco Services Incorporated

much improvement was obtained from each. The main items comprised:

1. Reconnecting the motor stator windings to give the next lower synchronous speed, thereby cutting down the surplus fan capacity not needed under existing load conditions.

2. Removing the 10-leaf louver dampers at the twin inlet boxes, and transferring the combustion control to a 2-leaf streamlined damper upstream from the dust collector.

3. Eliminating internal projections, braces, sudden changes of flow direction and sectional area, etc., thus streamlining the entire gas flow path from air heater to induced-fan, and minimizing turbulence.

4. Providing external stiffeners for flat-plate areas of breeching, dust collector and fan discharge duct into chimney base.

Installing sound-absorbent panels inside lower 45 ft of the chimney.

Additional acoustical remedies, some of a minor nature, were also tried. The objectionable noise was eliminated altogether, and has not recurred.

Cost of Noise Complaints

While the power and energy quantities in noise are extremely small, the sums of money expended for reduction and prevention are substantial. Comment has already been made on the price differential for power transformers built to have noise level lower than those sold at the base price — as much as 30 per cent cost increase. Similarly, forced-draft fans of characteristics giving minimum noise may require up to 40 per cent more outlay than the lowest-cost high-speed type of equal air-handling capacity, and a removable or permanent housing for quiet operation in an outdoor plant may add another 10 per cent. But if changes become necessary after a plant is in operation, or court action ensues, the expense incurred to solve the noise problem may prove still greater.

In one instance, involving a chimney 22 ft diameter which emitted noise caused by induced-draft fans, the corrective measures are estimated to have cost several hundred thousand dollars — excluding the higher fuel expense for power production on the utility system through the shutdown period of the new high-economy installation during the alterations. In a recent case that has involved general plant noise, the expense for acoustical diagnosis and remedies may exceed a hundred thousand dollars. A cooling tower for an air-conditioning system in a utility-company central office building, which offended guests in an adjoining hotel, required corrective measures exceeding $10,000 — as compared with $45,000 for the tower itself when erected.

With expenditures of such magnitude, it is evident that control of noise involves financial problems as well as technical. Decisions by management will be required during execution of a new project, to guide designers and operators in order to strike a balance between initial plant construction cost, exposure to the hazard of subsequent expenditures for corrective measures, and possible impaired relations with customers and the public at large.

Figs. 1 and 2 by courtesy of Consolidated Edison Company of New York. Fig. 3, Florida Power and Light Company. Fig. 4, Burgess Manning Company.

Recent Court Decisions

Noises from industrial operations and from public-utility properties have been held to constitute nuisance, in court cases brought in many states. The list of cases is growing; electric generating stations and substations, gas pipeline compressor stations, and other utility-company premises are included on the record. Usually, any threat of injunction has been averted by prompt and vigorous action to eliminate the objectionable noise.

The tenor of many decisions indicates that city and country dwellers alike must expect noise as an incident of modern living. Traffic noises in the area subject to complaint are often taken as the criterion for judging whether industrial noises may be deemed unreasonable. Extreme hardship or injury to health need not be proved; it is enough to establish a nuisance, if interference with his right to "peaceful enjoyment" of property can be demonstrated by the owner or the occupant of the premises affected.

Two examples that illustrate the trend of court cases will be cited. In the first, decision was handed down by a U. S. District Court, in an action brought against a natural-gas pipeline company by several owners of residences within a half-mile from a large new compressor station containing reciprocating compressor units. The noise was described as resembling a "never-ending freight train of empties", or the "hum and vibration experienced on an ocean liner", and in similar terms. It was said to be incessant, 24 hours daily, and seemed to increase at night.

Designer's Defense

The defendant pressed the contention, among others, that because the plant had been designed and constructed, and is being operated in accordance with the latest engineering practices in the industry, and furthermore was neither negligently constructed nor so operated, it should not be subjected to an injunction of any kind.

The decision handed down by the presiding judge, however, states: "the conclusion in law is that the plaintiffs have established that operation of the defendant's compressor station constitutes a legal nuisance. The design and construction of the station, with respect to elimination of noise and vibration, apparently was not considered with particular reference to the effect it might have on nearby residences, and on the personal and property rights of the plaintiffs." An injunction was granted, with the stipulation that it would not take effect until the defendant should make certain further changes at the station, and that conditions after completion thereof would be reviewed by the court before the conditions of an injunction would be specified.

The second case concerned the complaint of a Brooklyn housewife against a neighbor, whose bedroom air conditioning unit, she claimed, roared so thunderously that it kept her family from sleeping. The magistrate dismissed the complaint with the ruling that an air conditioner is another product of man's endless search for new means to further his personal comfort and well-being, and, as with most innovations, it is accompanied by minor disadvantages.

In the following table are listed items of equipment in power plants, gas systems and related facilities, for which noise-prevention measures have been required:

A — Steam Electric Generating Stations
- 1 — Steam Generating and Utilization Equipment
  - a — Boiler-drum and superheater safety valves
  - b — Vents used when starting up
  - c — Deaerator heater vents
  - d — Boiler feed pumps, with motor and turbine drives
  - e — Steam pressure-regulating valves and temperature-reducing stations
- 2 — Draft Equipment
  - a — Forced-draft fans, with inlet-vane control
  - b — Induced-draft fans
  - c — Breechings and draft-control dampers
  - d — Flyash and soot collectors
  - e — Chimneys and stacks
- 3 — Fuel-Handling and Preparation Equipment
  - a — Pressure-regulating valves for natural-gas fuel
  - b — Coal pulverizers, including ball-type mills
  - c — Mechanical vibrators for unloading coal cars
  - d — Coal conveyor systems
  - e — Ash disposal pneumatic systems
- 4 — Turbine-Generator Units
  - a — Steam inlet end of turbines
  - b — Exhaust casings
  - c — Generators, with hydrogen or air cooling
  - d — Control rooms

B — Internal-Combustion Engine Generating Stations
- 1 — Engine-Generator Units (especially high-rotative-speed type, 600 rpm and above)
- 2 — Combustion Knock
- 3 — Timing Gears
- 4 — Valve Mechanism
- 5 — Exhaust Gas Systems
- 6 — Air Intake Systems
- 7 — Superchargers, Exhaust Turbo-Type

C — Gas-turbine Units
- 1 — Axial Flow Compressors
- 2 — Combustors

continued on page 110

. . . WINTERIZING Milaca's Diesel Plant

If you begin now, there will be just about sufficient time to get your diesel plant in shape for the coming winter. Here's how they did it at Milaca to increase efficiency and help reduce their former winter heating oil costs by about 47 per cent

By D. L. COCHRANE

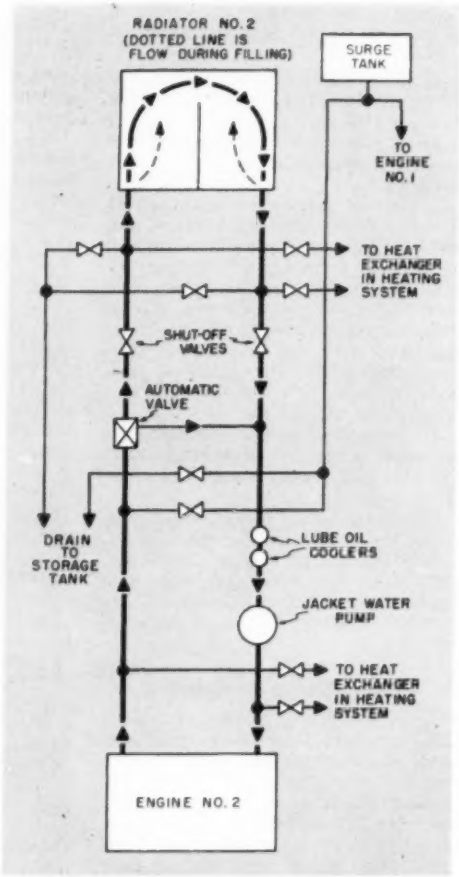


Fig. 1. Diagram of cooling system that has been designed to provide all-weather dependability for standby and emergency operation of Milaca's radial diesel engines. Not shown are fuel oil heaters connected to jacket water system and electric heaters for lube oil sump

WE FACED several problems in the winterization of our diesel plant. Being on standby 95 per cent of the time and at or near full load the other 5 per cent, some of the separate winterizing projects must be quickly changeable to a full operation status by one man.

Of the exterior surfaces to be sealed, there are ventilating louvers in the basement, a metal roll door in the engine room, overhead ventilating louvers in the engine room, and the top and front of the radiator room.

To seal the basement ventilating louvers we cut a sheet of "plastic glass" the same size as the frame, put it between the screen and window sill and replaced the screws, forcing them to pierce the plastic glass. When tightened, a good seal was obtained.

We built a wood frame and bolted it to the outer frame of the steel roll door (Fig. 2). To this wooden frame was fastened plastic glass with wood strips. After sealing the cracks around the wood frame with caulking compound we had nearly an airtight seal.

The engine room ventilating fan louvers are in a deep sheet metal housing and open electrically when the fan motors are started. We made frames of 1 in. x 1½ in. wood strips to fit tight inside this metal frame. With hinges on one side and cabinet latches on the other they work like a door. On these we fastened plastic glass with wood strips. A screw eye was put in the center of the front edge of each door for opening and closing. We use a window washing pole with a hook in one end to fit into the screw eye in the door (Fig. 5 — Left). If someone happens to turn on the fan without first opening its door, we know from experience they are strong enough to withstand the suction.

The building was originally constructed with adjustable metal louvers immediately in front of the radiators, but this proved useless for keeping out cold and we therefore built on a hanging "lean-to" shaped shed (Fig. 3). The doors are in the base and open upward. They could be cable operated, but for the limited number of times we open them they are pushed up by hand and blocked open by a board in the center. All of the front panels are removable by taking out the bolts. However, we found that for summer cooling it was only necessary to remove the bottom row of front panels and the base doors.

Engine Cooling System

Our radiator fans pull air in through the front of the radiators and push it out the top of the raditor room through a set of adjustable louvers. Between the top of the radiators and the bottom of the louvers we have horizontal sliding curtains of waterproof canvas. For the construction of these we called in an awning manufacturer and, with his regular material, designed a setup of two canvasses in each room as shown in Fig. 4. We anchored ⅜-in. pipes to the "I" beams on each side of the rooms. Steel rings, to which are attached the canvasses, slide on these pipes. With an arrangement of sash cord and pulleys extended to convenient height we can operate the curtains easily. One curtain is slightly higher than the other to allow for folds when they are open, but since they overlap about a foot there is only a small gap.

To make a good closure at the room ends we took some 12-in. wide pieces of plastic glass and fastened them to "I" beams with ¼-in. capscrews. Each of the same capscrews holds a long spring which we fashioned from wire to hold the plastic glass against the canvas.

The cooling system surge tank being in the radiator room we had to treat it also. We put a plywood covering over it on top and on one side — the wall being on the other side. As the room was only 8 ft wide, the plywood butted against each side. All seams were caulked and all available heat thereby kept in (Fig. 5 — Right).

We protect the surge tank gauge glass with electric tape which is energized with the light necessary to see the gauge glass. When the tank is empty, the light is turned off and, consequently, so is the heat.

The building's low pressure steam heating system is associated with the engine cooling system via a heat exchanger and a pair of small pumps which can be valved to the engines and/or radiators. (The engine cooling system is shown diagramatically in

Fig. 1.) This set-up will keep things in safe condition either during partial operation periods or crucial periods when operation on short notice is expected.

However, for day-to-day standby service we went one step further. We put in drain piping from below the base of each section of each radiator to our treated water storage tank, and also from each "engine-to-surge-tank" line to the same tank. Shut-off valves were originally put in between the engines and the radiators so we can keep water in the engines when the radiators are empty. The automatic temperature regulating valve is on the engine side of the shut-off valves so there exists a closed loop through this valve which can be used for water circulation as long as the water does not get hot enough to cause the valve to change the flow direction toward the shut-off valve. Consequently we can start the engines without filling the radiators and run about one-half hour.

Filling Radiators

It takes about ten minutes to fill the radiators and this can be done anytime during the half-hour. During extremely cold weather we found we must wait until the engine water is up to 130 F or the empty radiator will freeze shut as soon as the water starts to enter. At all times during the winter we fill the radiators by backing the water in from the engine rather than running it in the top of the radiators from the surge tank. Before the surge tank water level reaches the level of the pipe leading to the top of the radiators we open the shut-off valve on the engine discharge line to the radiator so the water comes in the radiator from below, filling up this side and into the header at the top of the radiators. When this header gets full, circulation starts in its normal direction. When we are doing this filling we only open the shut-off valves about 1 $\frac{1}{2}$ turns so the engine is not losing water in the closed system faster than the make-up water pump supplies it. We have a time schedule written up so a man can go down in the basement and do this filling of both radiators simultaneously and end up with the radiators full and proper level in the surge tank with no waste of time or treated water. After all filling is done the shut-off valves are opened all the way.

After we shut down and wish to go back on standby basis we close the valves between engine and radiator in each system and open the drain valves for each side of each radiator and for each side of the surge tank.

The first winter that we were really buttoned up like this was 1953-'54. Has it all been worth while? Yes, we have used about 40 per cent less heating oil and have had a more comfortable place to work. Availability and dependability are better than ever.

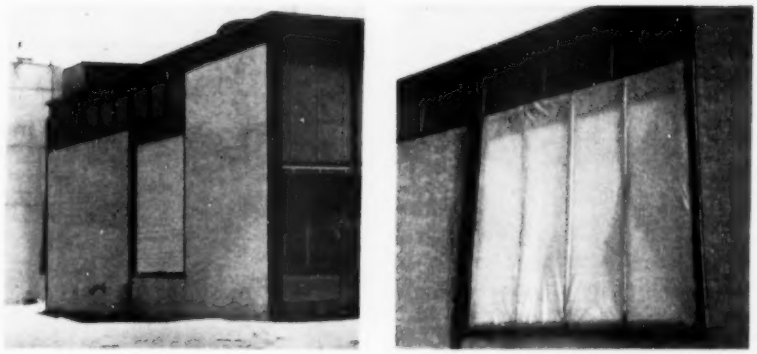


Fig. 2. Before and after views show roll door winterproofed with plastic glass

Fig. 3. Shed for radiator room louvers; lower panels come off for summer cooling

Fig. 4. Awning-type curtains seal outlet louvers in ceiling of the radiator room

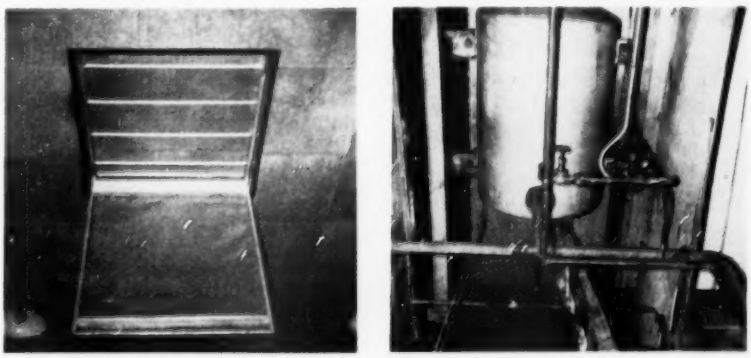


Fig. 5. (*Left*) Plastic-covered trap door for sealing overhead intake louvers in engine room. (*Right*) Looking up at surge tank protected by plywood partitions over top and one side. Electric heating tape keeps gauge glass from freezing up

Can We Afford to De-Salt Sea Water?

The picture looks bleak for irrigation, though studies are not complete. City supplies may be economic as some of the many techniques are refined through research, but power and/or equipment will cost someone plenty. Also, do not expect much help from the sale of the mineral by-products extracted

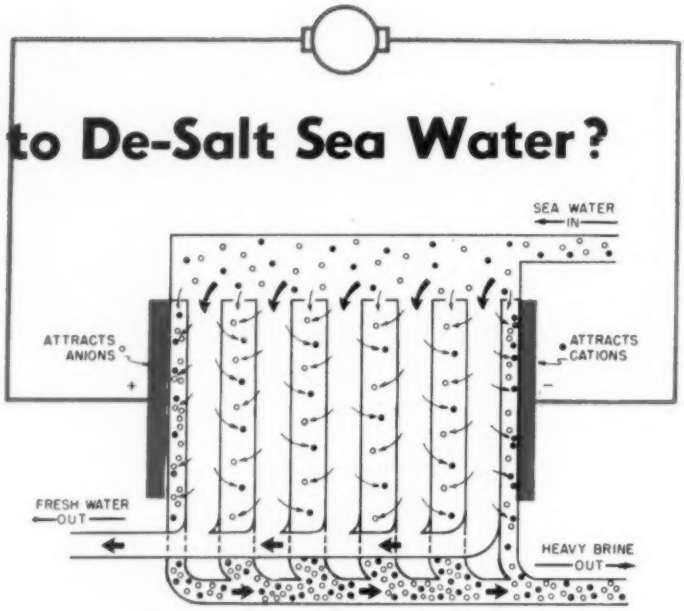


Fig. 1. Electrodialysis (above) induces anions to left, cations to right. Selectively permeable membranes pass one and block other to isolate ions in blowdown

RECENT YEARS have marked a decided increase in engineers' preoccupation with the problems of extracting fresh water from the sea. Unfortunately, the subject is of such popular interest that its complexity is often minimized for popular consumption, and this has led to much befuddled thinking and some interesting if fantastic schemes.

On the other hand, it may be fortunate that the public is so interested. Present thinking indicates that plants for the desalting of sea water will be extremely large and expensive — if significant amounts of fresh water are to be produced — and that the public will have to foot the bill.

Not only will the plants be expensive to build, but they will be very expensive to run. While it is not an iron-clad general rule, it is usually true that less expensive plants cost more to run because of less effective recovery of wasted power. This assumes, of course, plants of equal capacity.

Despite the many workable techniques conceived to extract fresh water from sea water, no one technique offers a "perfect" solution to *all* the requirements of public water supply. These requirements are: (1) Fresh water production in terms of millions of gallons per day, (2) at less than $0.40 per 1,000 gal for cities, (3) at less than $0.06 per 1,000 gal for irrigation, and (4) with a minimum effect on our fuel resources. Irrigation requirements in moderately arid regions will run about 3,258,000 gpd per sq mile, year-around capacity, stored for intermittent use. New York City requires 980 mgd, and has another 360 mgd committed from the Delaware River. Los Angeles and San Diego will soon need 1,000 mgd. While some processes now considered may yield water at less than $0.40 per 1,000 gal to meet city requirements, it is very doubtful that irrigation water can ever be supplied at $0.06 or less.

Even theoretically, a plant extracting fresh water from sea water (35,000 ppm impurity) must expend 2.6 kwh unrecoverable energy for each 1,000 gal of fresh water. On this basis, a plant irrigating a tract 10 miles long and 10 miles wide must expend 35,295 kw per hr continuously — without considering the pumping costs. The Los Angeles-San Diego supply would require 108,333 kw input, continuously, if extracted. Add another 10.4 kwh per psi head for every million gallons pumped to estimate induction and distribution costs. Since most water supplies, municipal or agricultural, are consumed well above sea level, the pumping costs cannot be ignored.

Electrodialysis

Some engineers believe the lowest purification costs are promised at this time by a new process called *electrodialysis*. This process employs unlike plastic membranes in pairs which screen out anions or cations respectively (see Fig. 1). Migration of the ions to their respective opposite poles is induced by positive and negative electrodes on opposite sides of the pairs of membranes. Migration is interrupted when the ions encounter a membrane which refuses passage to particles with their electrical characteristic. When sea water (or other solution) is introduced between two membranes with opposite permeability characteristics, the anions will flow through one membrane while the cations flow in the opposite direction through the other membrane. This leaves purified water between the unlike membranes, the purity depending on electrical charge at the electrodes, the residence time in the field of influence, and the condition of the membranes.

Both power and equipment costs for electrodialysis promise to be lower than for other methods of purification, at least partly because of the following characteristics:

1. The water is not heated or vaporized, thereby eliminating thermodynamic losses.

2. Action is taken against the impurity ions rather than the water. Since these are in lower concentration, it would seem to require less energy to remove the ions from the water than vice versa. (This would merely allow a closer approach to the minimum separation energy.)

3. It is not necessary to raise the pressure in the system, therefore avoiding pumping equipment and power costs for process pressures. It also permits lighter construction of equipment with the attending savings.

4. As concentrations in the water are decreased, the power requirement decreases. In distillation systems, the farther along the process, the more power it takes for the extraction of additional pure water.

The latter characteristic makes electrodialysis especially valuable for the purification of waters with higher initial purity because of the close relationship of power requirements to the number of ions to be removed. It is expected that this property will lead to the use of electrodialysis in proc-

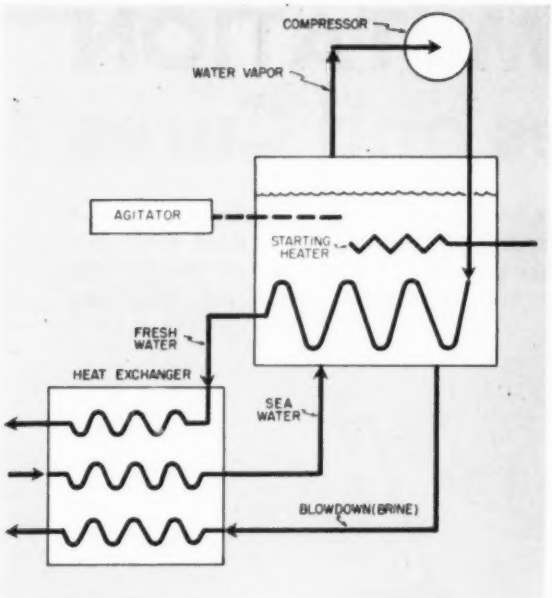


Fig. 2. Compression distillation may be improved by agitation of boiling liquid. Some give it edge over electrodialysis

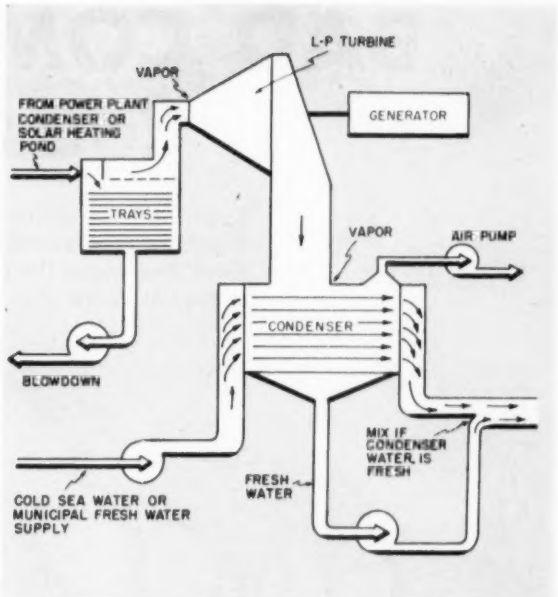


Fig. 3. Claude process employs 1-p turbine, temperature differences in waters. It may produce more power than it needs

essing brackish water in some western states for local consumption.

Power requirements for electrodialysis come closer to the separation energy minimum than any other method at this time outside the laboratory. Between 10 and 30 kwh per 1,000 gal is expected in large-scale plants with membranes now available. Recent developments in the field of solar-electric generation *might* supply that power for the cost of generating equipment write-off. Since low d-c voltages are required for electrodialysis, and increasing voltage with decreasing salinity, solar-electric generators might provide power considerably cheaper than could otherwise be generated to fit these requirements.

Compression Distillation

Runner-up in the fresh water business is the compression distillation system (see Fig. 2), familiar to most of us. Its new version shows even more promise than its predecessors, however, and power requirements are said to be drastically reduced. Compression distillation is inherently simple, and it has the advantage of a long history of use. Either internal combustion engines or electric motors can be applied to the process, the former usually being the more economical. It is fairly certain that advantages characteristic of the traditional compression distillation systems will apply as well to the modified version due out of the laboratories soon. The major difference seems to be that the liquid is agitated violently by some means to speed its evaporization, but insufficient information is at hand to justify predictions or conclusions.

Power consumption for this technique depends largely on the provisions for heat recovery, and to a certain extent on the provisions for heat insulation. World War II military units extracted 1,000 gal per (about) 6 gal of diesel fuel. Present diesel-driven units have cut this figure in half. Electrically-driven units have been built to extract 1,000 gal for 50 to 60 kwh. It would seem apparent that engine-driven systems offer the greatest economy — especially if a cheap, continuous source of fuel were available. Sewer gas might be the answer if plants were located near the sewage treatment plants for large cities.

Other Systems

Many systems for the purification of sea water have been proposed, and some of them make sense. As has been indicated by the preceding discussion, however, the problem is one of costs — *total* costs. Many schemes have virtually no power cost, but these require equipment investments which boost *total* costs well above those for the systems just discussed.

We learned long ago not to discredit ideas too hastily, for a factor making one solution impractical today may be resolved tomorrow by research or accidental discovery (the latter is becoming somewhat rare). Among the systems which may develop favorably through such activities are the following:

Freezing: — Problems are equipment investment, end-point purity.

Solar Evaporation: — Problems are size and cost of equipment, plus difficulties of condensation in hot climates where the method might otherwise be practical theoretically.

Super-Critical Distillation: — Problems are corrosiveness of high-pressure, high-temperature water, scale formation, uncertain equipment costs.

Claude Process: — (Temperature difference of sea waters) Problems are size and cost of equipment, restricted number of practical locations. All these may eventually be resolved by the right situation in which waste heat from other activities can be utilized, but plant will still be large.

By-Products

Detailed studies by competent engineers and economists indicate that plans to finance sea water purification through the sale of mineral by-products are not likely to prove practical. The very large quantities involved would be a detriment, since minerals comprise a skittish market at best. Dumping huge additional tonnages of low-production minerals (as are many of the sea-borne salts) would depress the market badly. Another problem is, who would own and operate the plant if a large part of its activities were devoted to mineral extraction? The U. S. government might be reluctant to enter this field of commerce, and certainly that field of commerce would not make the government welcome.

Thus, it can be seen that the problem of sea water extraction is not resolved in any of its many aspects. Cost rears its head each time a "practical" solution is reached. When power economy is attained, equipment costs soar. The best systems are more expensive than we would like them to be, but many factors are yet to be explored.

BAD COMMUTATION ... Causes and Cures

Case histories described here show you how to find out why a machine commutates badly and how to put it right once you have diagnosed the cause of the trouble. This article should help everyone who has to maintain and operate d-c machines

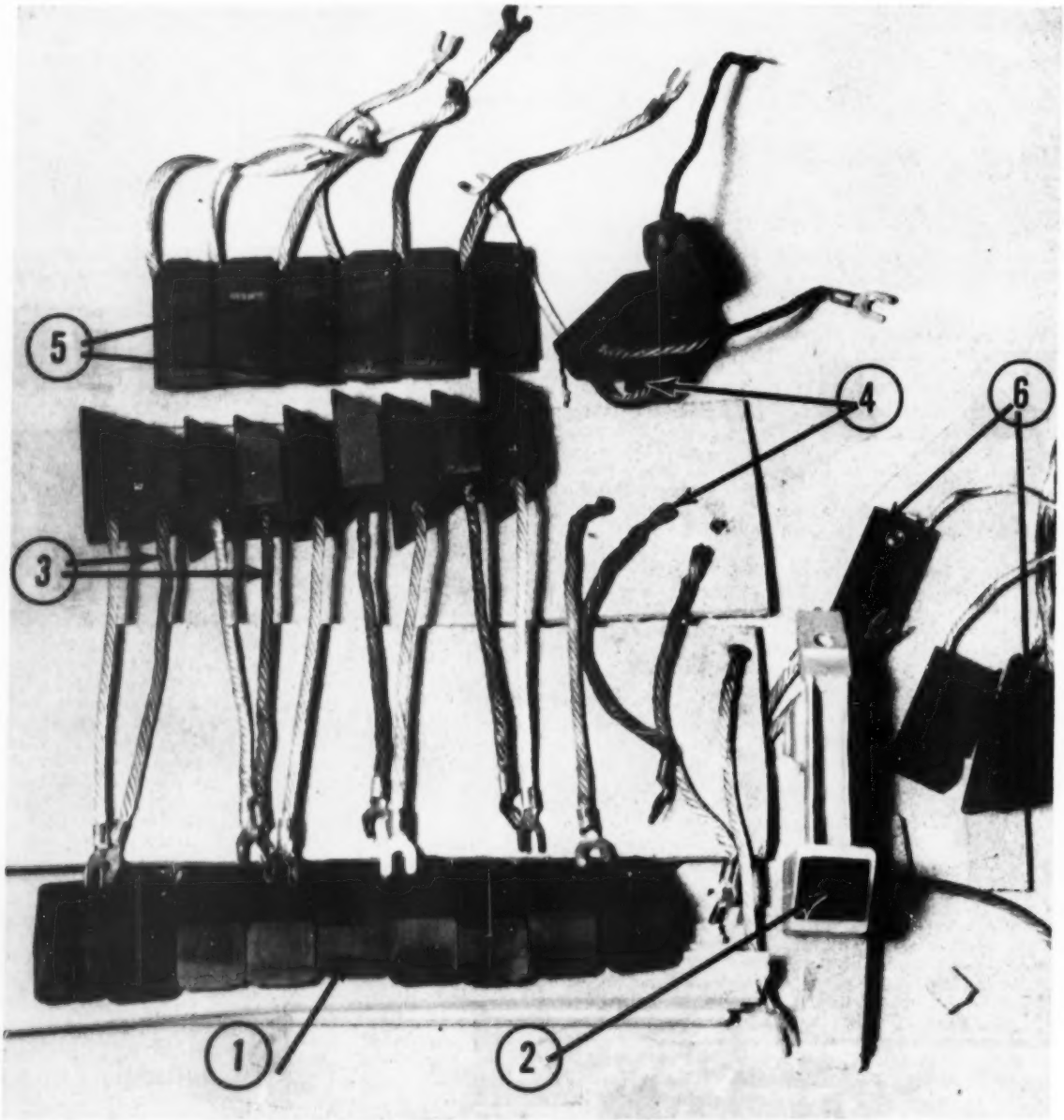


Fig. 1. Brushes show effects of various operating conditions, like right and wrong brush angles, chattering, and other factors causing poor commutation. Text shows how the conditions are caused and how they can be remedied

By CARL BOESMILLER*

COMMUTATION PROBLEMS and the solutions described in this article are probably not new but they may be of interest to those responsible for the proper upkeep of direct-current machinery in power plants and in industrial establishments. These are all problems that have been encountered in the preventive maintenance program of the Department of Water and Power of the City of Los Angeles.

The steps used in attacking the problems have been more or less standardized as follows: The machine having difficulty is first thoroughly checked for mechanical condition; if necessary, the commutator is ground true, polished, and undercut. The brush arms are checked for true spacing and parallelism to the commutator bars, proper brush angle and the mechanical condition of the brush boxes and brush tension arms. Over three fourths of the cases responded to this treatment.

Experience indicated that brushes, when properly seated to a newly stoned commutator, might commutate black, perhaps several weeks before sparking might occur. For this reason it has been the practice to place a machine in service for a month or more during which time the machine is watched closely for indications of trouble and, if any sparking starts to occur the following steps are taken.

Preliminary Tests

1. A running neutral setting is made on the brushes. A running neutral is set while the machine is running. The residual field is bucked to zero and a small current is applied to the commutating poles. The voltage generated by the commutating pole flux is read on two knife edge brushes in adjacent brush holders. This is shown in item 2 in the photograph, Fig. 1. The voltage will reduce to zero when the electrical neutral is crossed. This makes possible an extremely close setting to the true no-load neutral.

2. The compensation of the commutating pole, and if so equipped, the pole face windings, are determined by the Black Band method. This method is used to determine the relative strength of the commutating pole and, if the machine is so equipped, the pole face windings. This method entails visual observation of the sparking of the brushes as influenced by subtracting from or adding to, the commutating pole and pole face strengths while the machine is carrying load.

These tests are always supplemented by brush potential readings taken during progress of the work. These brush potentials are the readings from points on the commutator spanned by a brush and give an approximation of the current distribution under the brush face.

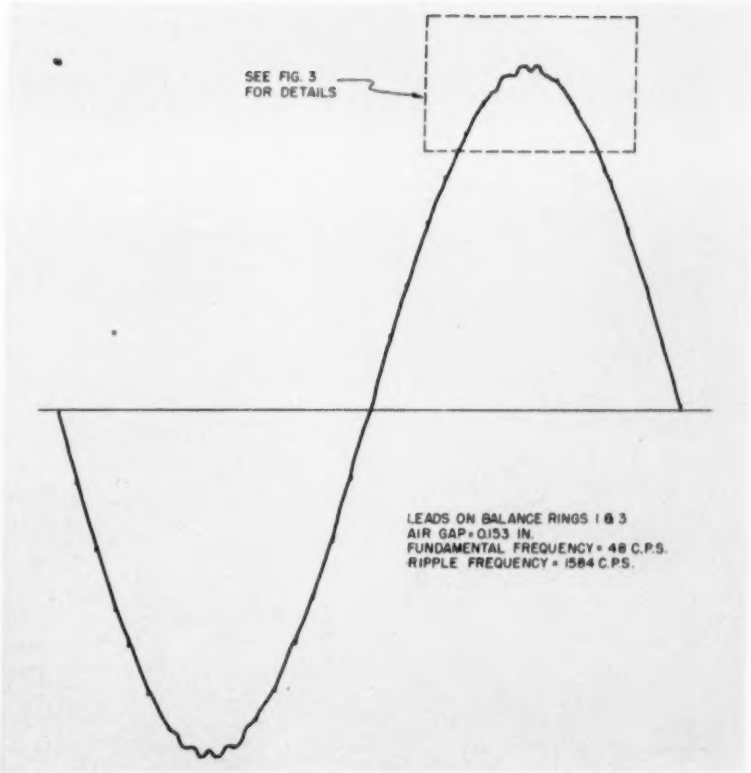


Fig. 2. Oscillograph showing part of no-load voltage curve of a 1200 kw m-g set

This test procedure and method of adjustment was applied to a 62,500-kva frequency changer with excellent results. This machine had to be shut down every three months in order to perform major repairs on its two 260-kw exciters. The commutator films on these exciters would break through with severe cutting and grooving of the commutators. A set of brushes would wear out in three months. Changing the brush grade made no improvement. After giving these machines the full treatment outlined above they have given no further trouble, indeed, they have now operated continuously for over seven years with only minor adjustments. The excellent condition of the commutators no longer makes unscheduled shutdowns mandatory and the life of the brushes has been increased over eight times.

A number of difficulties have been experienced due to insufficient brush angle. Detail 5 in the photograph shows the effect of this type of operation. These brushes are from 28 deg reaction type brush holders. The polished sides and chipped edges are the usual result of chattering brushes.

Another serious result of insufficient reaction angle is double facing of the brushes. The brushes represented by Detail 1 in the photograph show as many as three faces or positions of wear. This condition is transitory and may not always be found by inspection. Usually when a brush is changing its position in the holder, it will emit a shrill squealing noise, audible for some distance from the machine. While not as spectacular as a noisy chatter, the effects on the commutation may be equally disastrous. The brushes riding on the heel area will sometimes throw off streams of sparks and comets, even getting white hot at the trailing edges.

One of the Department's 1200-kw machines was adjusted from a 28 deg brush reaction angle to 31 deg. Although improved, this generator is still somewhat of a borderline case. On another machine, duplicate in all details, the brush angle was increased to 36 deg, resulting in a far superior performance to the first machine.

Brush Chatter

In another instance a large number of station battery charging generators of 5-kw to 7½-kw capacity would score with a wide bright band cutting through the commutator film, requiring re-stoning and polishing of the commutator every few months. The brush holders of all these machines were of the radial type with the brushes approximately perpendicular to the commutator. Immediately after stoning and polishing a commutator, the brushes would sometimes vibrate with a shrill chattering noise audible for some distance. A slight pressure on the brush pigtail or

* General Plant Division, Department of Water and Power, City of Los Angeles

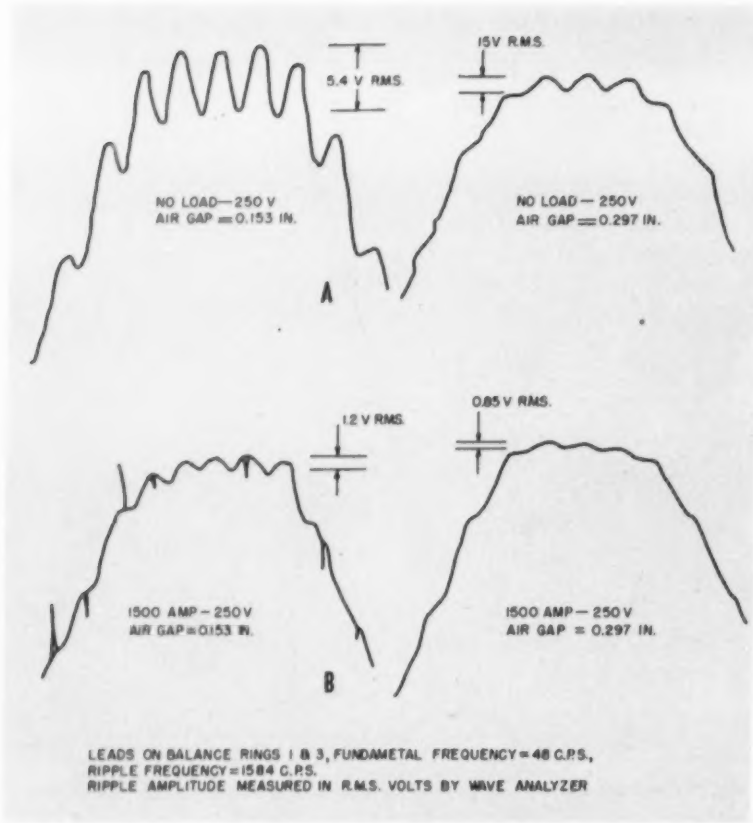

15V R.M.S.
5.4 V R.M.S.
NO LOAD—250 V
AIR GAP = 0.153 IN.
NO LOAD — 250V
AIR GAP = 0.297 IN.
A
0.85 V R.M.S.
1.2 V R.M.S.
1500 AMP — 250 V
AIR GAP = 0.153 IN.
1500 AMP — 250 V
AIR GAP = 0.297 IN.
B
LEADS ON BALANCE RINGS 1 & 3, FUNDAMETAL FREQUENCY = 48 C.P.S.,
RIPPLE FREQUENCY = 1584 C.P.S.
RIPPLE AMPLITUDE MEASURED IN R.M.S. VOLTS BY WAVE ANALYZER

Fig. 3. Part of Fig. 2 enlarged to show how ripple was reduced by altering air-gap

touching the commutator with the finger to lubricate it would stop the brush squealing. The problem was unquestionably not electrical as these machines float on the station batteries at less than 10 per cent of their ratings.

Measurements of the angle between the face and the side of the brush revealed the interesting fact that the brushes were not perpendicular but that some actually pointed a few degrees against rotation. Others on the same machine were trailing properly a few degrees. To visualize what was happening, the reader might hold a lead pencil by the point with the pencil almost perpendicular to the desk and rub the eraser across the surface. As the pencil is pushed or leading, the eraser will jump and chatter, but when the motion is such that the pencil is dragged or trails, the movement is smooth.

The brush holders on one of the machines were reset to allow all the brushes to trail from 3 to 7 deg. The operation was such a success that the remaining 18 generators were similarly treated. All these machines have now run for over five years with no further commutation trouble. New brushes started quietly and never chattered or squealed and the commutators all attained a good polish.

Two generators, a 250-kw and a 400-kw, had for many years suffered from poor commutation, resulting in burned bars. A study revealed that both machines were rotating against brushes which were inclined only 15 deg. It was then obvious that the forces of commutator friction on the face of the brushes were much greater than the small reaction force set up by the 15-deg brush angle. Both of these machines were then reversed in direction so that the brushes were now trailing 15 deg. The commutation troubles immediately disappeared. After five years of operation, both of these machines are in excellent shape.

It is a well-known fact that brushes are made by the various manufacturers for multiple characteristics with emphasis on certain features. Brushes are listed in the catalogs of the different manufacturers with similar frictional, resistance, and other characteristics that apparently make them interchangeable. Unfortunately this is not the case. One make of brush may meet the listed requirements, but for example, the carbon dust from the brush may be of a gummy nature and pack in the brush holder, causing the brush to stick. This same brush may build a film on the commutator that is also gummy and is subject to cutting through, scoring and grooving.

One of the carbon brush manufacturers has successfully produced a line of brushes that are excellent for high current collecting. They may be used on commutators that run at higher temperatures or that would spark and burn using ordinary brushes.

Some years after successfully using this brush on several difficult machines, they were ordered in quantities and placed in a great number of machines, principally 5 to 7½-kw battery charging generators. These generators were lightly loaded and ran with cool brushes and commutators. The results were all bad. All the lightly loaded generators would seriously groove and cut, requiring frequent polishing. This brush was replaced with another grade, made by the same manufacturer, which our tests have shown to be suitable for cool operation, resulting in the elimination of commutator trouble on all but a few machines.

Tracking

An interesting sidelight on brush film is shown in the following experience. During the Department's frequency change, a consumer's small 5-kw exciter came under observation. Both the positive brushes tracked on the inside end of the commutator and the two negative brushes tracked on the outside end. The commutator under the positive brush was a bright golden color appearing as though it were etched clean with acid. The surface of the commutator had small flakes of copper adhering to it. There were also small particles of copper in the faces of the positive brushes. A polished groove was worn several thousandths of an inch deep across the whole positive brush track. That section running under the negative brushes was a perfect jet back color with an extremely high polish and no commutator wearing.

This may suggest that the negative brushes on a generator, assisted by the natural oxidizing of the copper current carrying surfaces, are responsible for the dark films and polishing of commutators, while the positive brush tends to remove the film, giving the film the characteristic coppery dark brown color.

Reversing Polarity

The principles are not new, but rarely does one see a condition as bad as this. The effect can occur on the surface of collector rings for the direct current fields of condensers and generators, and for this reason the Department reverses the polarity applied to the rings.

When the load neutral is not properly located under the brush, a high value of current circulates across the face of the brush, entering at one edge and leaving at the other. This, of course, occurs both under the positive and negative brushes. In effect, any one brush will try to develop both the conditions described on the above-mentioned exciter. One edge may deposit some carbon on the commutator, *continued on page 104*

ANNUAL SHUTDOWN — Time for Repairs

When Norton Company of Worcester, Mass., made their annual spring boiler inspection, they found it necessary to rebrick the fireside facing of one of their steam generators. It is probably no coincidence that their own brand of silicon-carbide brick was used to make the workmanlike repair. Norton's photos show how

Fig. 1. An inspection of the cracked and sagging fireside facing revealed that the bricks in the tie-in courses had failed, permitting the facing to pull away from the main structural wall

Fig. 2. (Left) Old brick was replaced with silicon-carbide brick except where necessary to line up tie-in courses with the old wall

Fig. 3. Since only lower part was rebricked, upper wall was shored. Before laying, brick was dipped in thin cement mix

Fig. 4. Completed job. Note expansion joint in center of wall. Silicon-carbide bricks will resist slagging and clinkers

Fig. 1. Trailer camp lined up outside Hydro-Quebec's Montreal service center

Working Is Easy at New Service Center

In July we described Hydro-Quebec's fine new service center. Here we show how the convenience of their workmen has been considered and how it has paid off in fast material handling

INDOOR STORAGE AREA for the Commission's materials and equipment covers an area of 157,200 sq ft. In addition, an outside storage yard extends along the entire rear depth of the service center. This outdoor storage includes a pole yard and storage space for pipes and heavy equipment that can be left outdoors. The hard Canadian winters make inside storage necessary for many materials which in better climates could be stored outdoors.

At the receiving dock, four trucks can discharge their loads simultaneously. A 10 ton bridge-crane helps to unload heavy materials at this point. A railroad spur runs alongside the dock so that heavy equipment transported by rail can be unloaded directly into the stores.

Materials and equipment used by a public service utility are so varied that facility of access, easy handling, and rapid transit are essential to this kind of stores. A greater variety of fork-lift trucks, tractor-trailer trains, and pallet racks are required for this kind of stores than would be usual in an industrial plant manufacturing one type of equipment only. A number of standard racks and trolleys are used by Hydro-Quebec for their wide variety of materials and equipment.

In the pole yard the double handling system illustrated in Fig. 5 is used. With this method, the first load of poles to come to the Center is stored between vertical supports in space B. These supports consist of I-beam sections embedded in concrete. As poles are required for service, they are taken from this group in space marked B. If, in the meantime, a new load of poles comes to the Center for storage they are stored between posts in space C. This load is not touched until all the poles have been removed from the space first filled at B. This system insures that no poles are left at the bottom of a pile for long periods. The mobile crane shown in Fig. 5 has remote control so that the man operating the crane can also operate the vehicle.

As in the garage, the lighting throughout the storage area is of high intensity and very uniform.

Mobile Camp

Much of Hydro-Quebec's territory lies in the hinterland of Quebec Province, and crews often have to work for long periods in uninhabited bush country hundreds of miles from the nearest large town. In the old days much time and money was spent setting up camps, transporting fuel, water and supplies, and keeping the camp going once it had been established.

Now the situation is very different. Operating out of their Montreal service center, Hydro-Quebec has a fleet of trailers that make up a completely equipped mobile camp. The camp can take as many as 75 men to any part of the province, and within two hours of arrival can provide hot meals for everyone and then maintain

Fig. 2. Crossing Jacques Cartier Bridge

Fig. 3. Bunks inside dormitory trailer

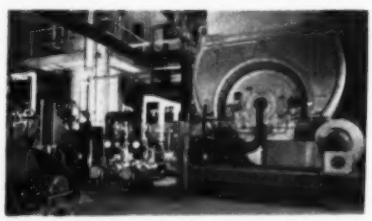


Fig. 4. A clean and compact power plant

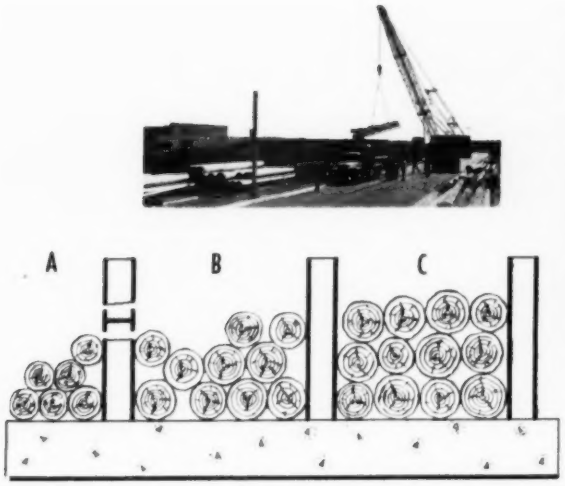


Fig. 5. Photo shows handling in the pole yard, and diagram illustrates double handling system explained in text

Fig. 6. View of general stores area showing how light and clean they are and how much maneuvering space is available

full camp facilities indefinitely. Each of the five dormitory trailers have bunks for 10 men, and each trailer is complete with washing and toilet facilities. The kitchen trailer is equipped with modern stainless steel cooking equipment and complete refrigeration and food storage facilities. The dining room trailer can be used also as a recreation room.

Improved Working Conditions

Each trailer is hauled by a one-ton panel truck, and with the camp goes a 2000 gal water truck, complete with pumping equipment for filling from the nearest river or lake. Power for light and heat comes from a 50 kw diesel engine driven generator. Fig. 1 shows the camp lined up at the Service Center, and Fig. 2 shows them leaving Montreal by Jacques Cartier bridge. They are specially built to stand travel over rough bush roads and tracks, and in the two years they have already been operating they have proved remarkably successful.

Although personnel attached to mobile crews seldom frequent the service center, provision has been made for their welfare when they do. A waiting room has been placed at the disposal of drivers whose vehicles are undergoing minor repairs, and comfortable tables have been reserved on the ground floor for members of mobile squads of the Gas Department, Installation Division and the Transmission and Distribution Sections.

An up-to-date stainless steel kitchen and a large cafeteria shown in Fig. 7 provide the many hundreds of employees with excellent and wholesome meals at reasonable prices.

A registered nurse is in constant attendance at the Service Center, permitting prompt first-aid for sick or injured employees. The medical facilities of the center are up-to-date and very complete.

Fig. 8 shows the up-to-date washroom facilities. An interesting point to note here is the floor construction underneath the lockers. In most washrooms lockers get damaged by frequent kicking at their bases. By making concrete pedestals, about six inches high, under the lockers, damage is prevented and the lockers last many times longer than with the normal method of setting them straight down on the floor.

Fig. 9 shows one of the classrooms for training linemen. In the background is a model line on which the beginners practice repair and emergency techniques. In another part of the room are full size lines and poles at floor level on which the students can practice still further. In the background of Fig. 9 will be seen two trolleys on which are mounted the standard tools, equipment, and materials that the linemen will use when they go out on emergency jobs. In the class room they have the opportunity to familiarize themselves at leisure with the appearance and application of the tools and equipment they will have to use in emergencies.

Security

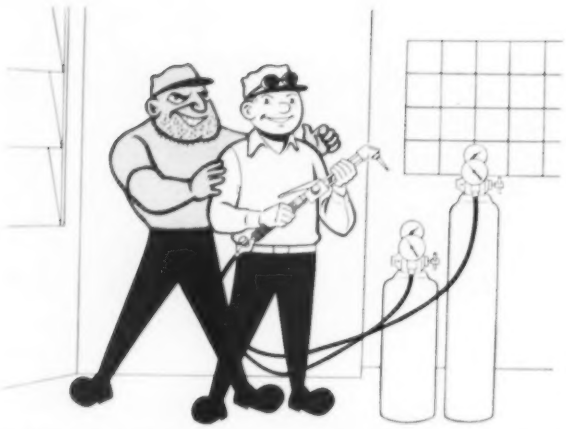
In addition to a guard house at the main entrance, and watchman's key signalling points at various parts of the Center and the usual visitor's pass and badge system, the main building is divided into sections which can be locked apart from each other. Thus, a man who works in the meter section has a key which admits him to the meter section but not to any other. Only the chief engineer and his assistant have master keys that permit them to enter any department in the building. This arrangement makes it difficult for unauthorized personnel to enter any section of the building, and minimizes wandering between one department and another.

Fig. 7. View of part of large well-lit cafeteria for service center employees

Fig. 8. Washroom. Raised floor under lockers prevents damage by kicking

Fig. 9. Linemen's class. Trolleys show all the tools they need in emergencies

New Film Teaches Safe Welding



The two principal characters. The good welder, and behind him the foolish and dangerous guy who causes all the trouble

A NEW FILM is now available for teaching good practice and safety in electric welding and oxyacetylene cutting equipment. The film uses cartoon characters, one of which is shown here, to emphasize important points. This sound slide-film has been designed for companies to train their own employees in the safe use of welding and cutting equipment.

"The Guy Behind Your Back" as the film is called, presents the serious business of safety in welding in a way that is easy to absorb. The story is presented in a light, but not comic, manner; it is illustrated with many cartoons, and is accompanied by an easy-going narrative. It lasts 20 minutes. The film is available for free showings, or it may be purchased at a nominal cost of $15 each.

For more information about this training aid write to the Editor, or use one of the prepaid post cards elsewhere in this issue. Just write WELDING FILM on the card and mail it to us.

400 Cycle Fluorescent Lighting ... More Light for Less Money

Here's the first installation of new type lighting for which widespread use is predicted. Fluorescent lamps at 400 cycles give as much as 50 per cent more light than at the normal frequencies

THE NATION'S most modern and efficient general lighting system, in which the individual fluorescent lamps will produce about one-fourth more light than normal, will be installed in Union College's Alumni Memorial Field House.

This was announced by the General Electric Company, which has designed a system of high-frequency fluorescent lighting for the new building. The field house is now under construction as a memorial to the 76 Union men who lost their lives in World War II. Work is expected to be completed by December of this year.

GE reports that the lighting system will represent the first application anywhere of this principle of high-frequency fluorescent lamp operation to the general lighting of a large area.

Because of its expected economic advantages, John H. Campbell, G-E illuminating engineer who has pioneered in this field, predicts that the new lighting technique will find widespread application in commercial, industrial and institutional buildings.

The new lighting technique involves a coördinated system in which all components are designed to contribute maximum advantages to lamp and fixture operation. Fluorescent lamps operated under the new system can produce from 20 to 50 per cent more light than they do in conventional lighting installations.

In this new installation the fluorescent lamps will be operated on 400-cycle power. Increasing the current to 400 from the standard 60 cycles will be accomplished by means of a low-cost rotating-type frequency converter. This unit consists of a high-frequency generator driven by a 60-cycle electric motor. The 400-cycle ballasts used to control current in the lamps are much simpler, more efficient, and 80 per cent lighter in weight than conventional ballasts.

More than two-thirds of a mile of fluorescent lamps will be employed in the structure. A unique feature of the lighting job will be a new-type fixture. Each of the 35 fixtures, eight feet square and having less than half the weight of comparable fixtures in conventional installations, will contain 14 eight-foot-long slimline fluorescent lamps. Each lamp will produce over 6000 lumens, or units of light, giving the entire lighting job a total output of about three million lumens.

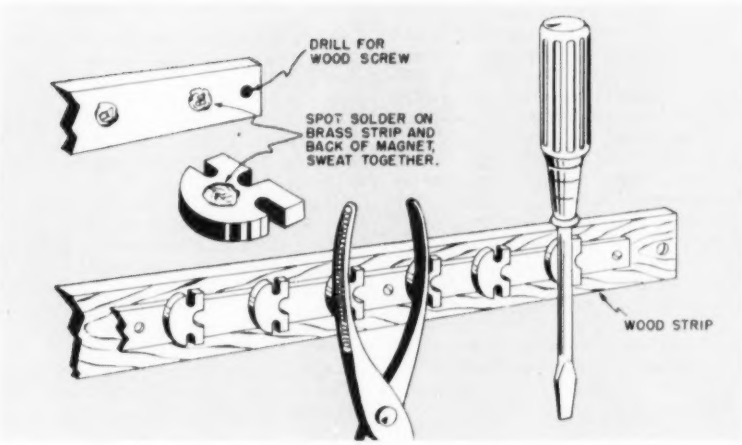
The 400-cycle power will be distributed to the fixtures at 600 volts, with 300 volts to ground. This distribution system is said to result in a considerable initial saving of money. Wiring layout for the installation was made by Howard D. Kurt, GE electrical engineer, who also helped design the power system.

Although somewhat similar systems have been developed for airplane and bus lighting, the Union College lighting job will be the first of its size to be lighted by means of 400-cycle power.

PRACTICAL ENGINEER and ELECTRICIAN SECTION

Magnetic Tool Rack from Discarded Meters

By W. H. CHARLES



THERE ARE MANY types of small-sized magnetic tool holders on the market, but our maintenance department came up with a king-size holder made entirely from scrap. The essential parts were salvaged alnico magnets from damaged and discarded ammeters and volt-meters, mounted as shown in the drawing. The steel pole pieces are broken off and the magnets then ground clean before tinning. Procure a suitable strip of brass and spot it with solder where the magnets are to be located, then sweat the magnets in place on the strip. Drill holes in the strip and screw it to a piece of hardwood for mounting over the bench. This device will hold heavy tools, including pliers and snips if the magnets are properly spaced to accommodate them.

Bus Bar Maintenance

By L. W. FITZPATRICK

EXPOSURE OF COPPER to the atmosphere causes troublesome oxide formations in many bus bar installations. The resultant increased electrical resistance also raises bus bar temperature and may induce equipment instability.

Copper oxide formation and corrosion can be minimized by coating surfaces with an inexpensive sodium cyanide and silver nitrate solution. This simple plating solution is a substitute for more expensive electroplating.

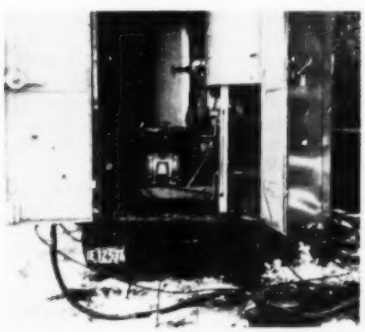
The following formula will provide enough solution to cover approximately 100 sq ft; proportionate reductions can be made for smaller areas:

Distilled water	2 qt
Sodium cyanide crystals	1 oz
Silver nitrate crystals	½ oz

First, dissolve cyanide in the distilled water; then add the silver nitrate and stir solution thoroughly. (Care should be exercised in handling this solution as it is very poisonous. Rubber gloves and a respirator should be used.)

De-energize the busses and clean them well with steel wool and dry cloths. The plating solution can be applied by a cloth or a swabbing brush.

Painting bus bar joints with aluminum paint will show overheated sections by discoloration of the paint. It will also show up bolted joints that need tightening to reduce resistance. For this purpose use a medium priced paint instead of high-temperature silicone-based aluminum paints which do not discolor easily.



A mobile steam generator "on the line"

Now, Emergency Steam in a Truck in a Hurry

PLANTS in the Chicago area (and possibly others) have a new source of emergency steam which is available whether they have a railroad siding or not. The new service, based on truck-mounted package boilers, was initiated just in time for the De-Paul University boiler room fire on March 1, 1954. This fire, while confined to the boiler room, was sufficiently destructive to close down operations until extensive repairs had been made. Emergency service by a truck-mounted boiler avoided a shut-down while repairs were being made.

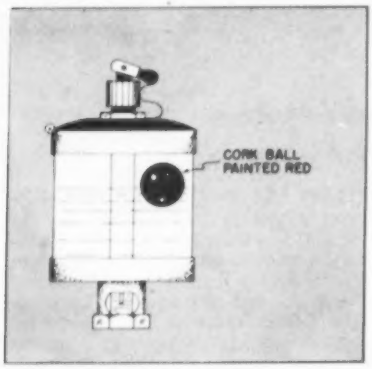
Fifteen to 100 horsepower of boiler capacity are available in that area through the mobile service. Presumably, multiple units can be connected in parallel to provide greater capacity if required. The units are fully automatic and self-contained, and can reach full pressure in five minutes.

Though the service was instituted by the Chicago firm to eliminate the need for expensive standby equipment on a rental-as-needed basis, the units can be purchased outright.

Easy to Read Oilers

By CHARLES PENOKIE

OUR PLANT has a large number of drip-feed oilers in which we use a light water-clear oil. It was difficult to determine the oil level unless quite close because of the transparency of the oil.



Drip-feed oiler with red cork ball for the quick indication of clear-oil level

We solved the problem by dropping a small cork ball, painted red, into each oiler. This enabled the operator to determine the oil level at a glance even though at quite a distance from the equipment, and we have had very little trouble since with dry spindles.

Testing Ground Wires

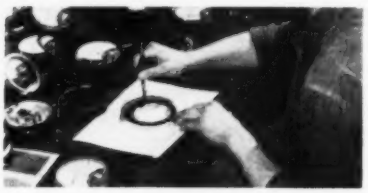
WHEN EXPERIENCE showed ground wires defective in several cases at the Jeffersonville Boat & Machine Co., a simple continuity tester was made up to check grounding connections on all portable electrical equipment.

A nail was driven through the end cap of an ordinary flashlight and soldered in place to act as a prod; a wire test lead was connected to the insulated terminal on the switch and taped securely to anchor it to the flashlight body. To test a piece of equipment — such as a drill — the test lead is clipped to the ground prong on the cord plug and the nail touched to several points on the drill casing. If the bulb lights, the ground connections are satisfactory.

Use of a flashlight for this purpose has a definite advantage because the low voltage employed will show up even poor connections in much the same way as an open circuit.

Gasket Anti-Seize

INSTRUMENT covers of glass or plastic, if assembled tightly enough to prevent moisture and dust encroachment, are frequently hard to remove when servicing time comes around. In many instances, the sealing gasket is destroyed when the cover is removed, and replacement is necessary.



Colloidal graphite is brushed on to prevent seizure and damage to gasket

This problem can be avoided if a thin film of colloidal graphite suspended in water is brushed on mating surfaces before assembling the gage. Such a material is fundamentally a solid of low shear strength which permits a tight, leak-proof fit to be broken with a slight twist of the mating parts. This allows the gage cover to be removed without replacement of the gasket.

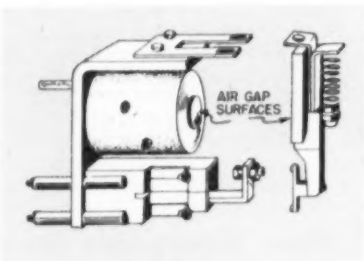
Prevent Magnetic Sticking of Contactors

R. S. KERCHER, Cline Elec. Mfg. Co., and L. E. Markle, Westinghouse Elec. Corp., writing in a recent issue of *Maintenance News*, a Westinghouse publication, discuss a problem common to all users of relays and contactors — the magnetic sticking of armatures to stationary cores after operating coils have been de-energized. Because this condition is of general interest, the article is being reprinted here with the permission of *Maintenance News:*

"Magnetic contactors and relays sometimes remain closed after their operating coils have been de-energized. This condition is generally termed "sticking." It is most apt to occur on small devices where spring pressures, tending to force the contacts open, are relatively weak.

"Contactors and relays that are operated by d-c coils will always have some residual magnetism in their magnetic circuits after the coils are de-energized. The residual magnetism may be strong enough to hold the device closed after the operating coil is de-energized. This condition is described as "magnetic sticking." Magnetic sticking is not so common on devices that are operated by a-c coils.

"Magnetic sticking can be eliminated by adding a thin shim of non-magnetic material in the magnetic circuit. Convenient places to add the shim are on the face of the stationary core of the coil or on the corresponding face of the movable armature. This method of correction is very effective on d-c operated devices. It is not so satisfactory on a-c operated ones because the addition of a shim in the air gap area causes a-c operated devices to operate noisily and with a continuously pronounced humming noise. Fortunately residual magnetism is not so apt to cause magnetic sticking on devices with a-c coils.

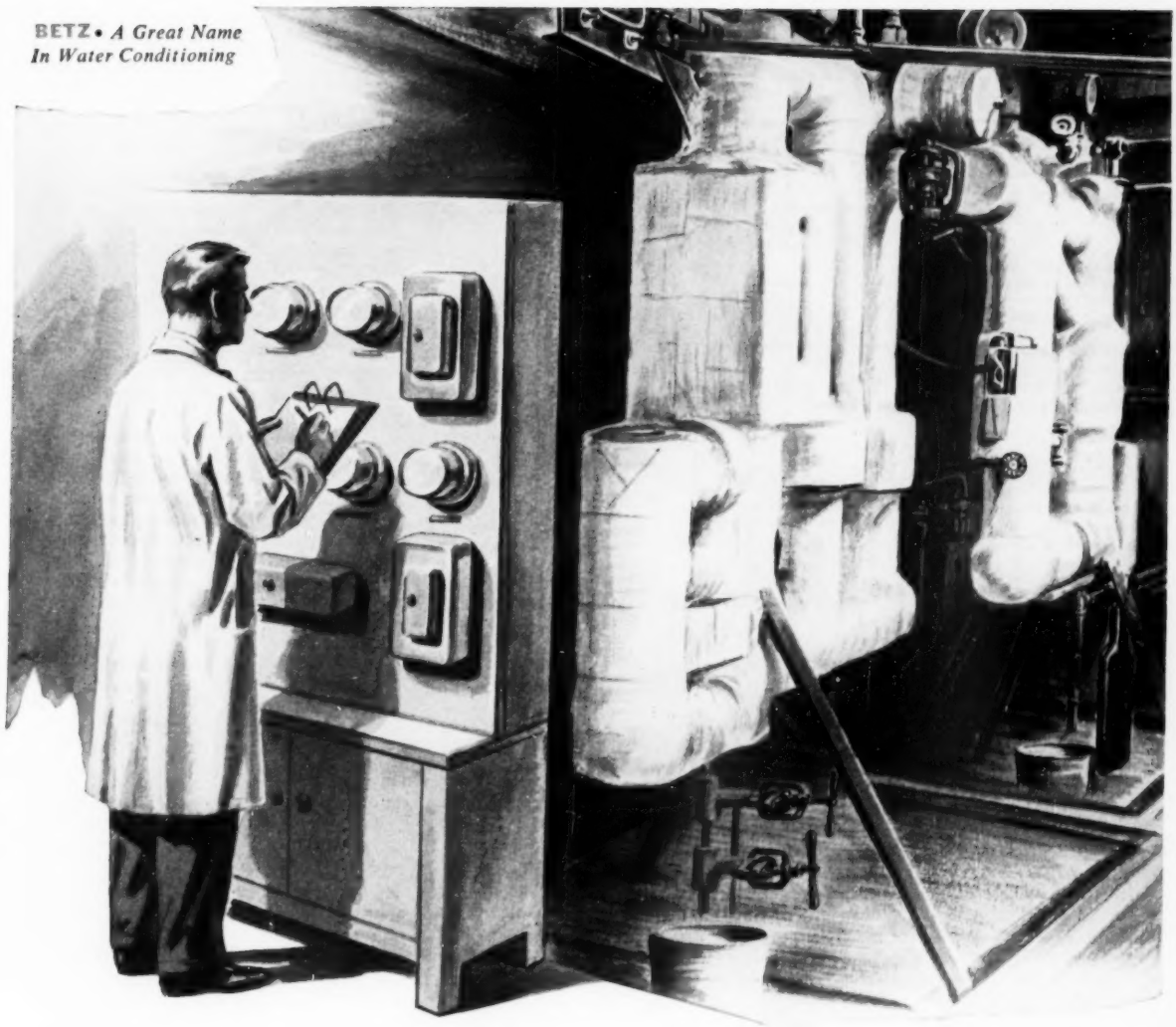


Exploded view of a typical relay showing surfaces which may cause sticking

"The air-gap surfaces on the stationary cores and movable armatures of a-c operated devices are closely fitted to obtain quiet operation. These surfaces are often filed to obtain close fits. To prevent rusting during shipment, with consequent noisy operation when put into service, the filed areas may be covered with a light coating of lubricant. This surface should be wiped clean of any excess lubricant before placing in service, because the excess lubricant may cause a "seal" that will hold small devices in the closed position after the coil is de-energized.

"Certain vapors and unusual atmospheric conditions will deposit sticky films on air-gap surfaces that may cause devices to stick in the closed position. Dust and dirt may cause tight bearings that produce unsatisfactory operation. Chemical plants, cement mills, grain elevators, ink vapors in printing press rooms, coal dirt, metal mills and similar installations are typical examples of atmospheric conditions that may cause devices to remain closed after operating coils are de-energized. Such conditions must be corrected by removing the dirt and dust with compressed air or vacuum cleaners or by wiping the surfaces clean with suitable solvents."

BETZ • *A Great Name In Water Conditioning*



Proving ground for an idea

Many of today's industry-accepted water conditioning techniques were unknown just a few short years ago. Yet they were made possible by the extensive research which is carried on daily at our headquarter laboratories in Philadelphia.

Little wonder then, that we consider our *continuing* program of research and development so important.

The testing and retesting of new chemical compounds and formulations—*under actual plant conditions* in complex "Tom Thumb" equipment like this—is only a small part of our research program conducted to assure better water conditioning for industry.

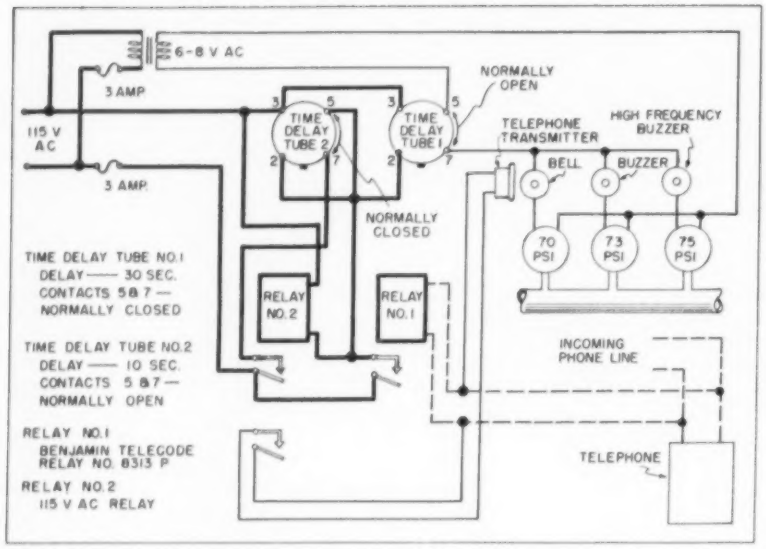
As a result, advanced Betz discoveries, tested in the laboratory and *job-proved* in the field, have vastly increased operating efficiency and economy in industrial plants, petroleum installations, and institutions—everywhere.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

For more data circle 546 on Post Card



Robot Telephone Pressure Transmitter

By F. X. HALLORAN

AN ADAPTATION of the pressure-switch transmitter system, described in the January, 1954, issue of POWER ENGINEERING under the title of Poor Man's Telemetering System by this author, provides an inexpensive system which immediately signals pressure readings at any installation via telephone.

Always available are audible checks of the three pressure switch ranges at any convenient telephone. Reservoir levels, pumping station pressures, and even power plants unattended at night can be checked to determine whether a desired pressure is being maintained.

Relay No. 1 is a component part of regular loud ringing telephone bells, and is a ailable at electrical jobbers. It is the only part of the circuit permanently connected to a telephone system.

The additional telephone transmitter provides an audible check of equipment in operation. The installation of a complete and separate telephone unit is optional, since a single telephone circuit with an assigned exchange number will suffice.

Power is obtained from the service leads and such transformers as are necessary. An inoperative sound signal will automatically show "power off" at the installation.

The thermostatic time delay relay tubes mount in regular octal radio sockets and are available in nine different time spans from 10 seconds to 2 minutes. In this system, a 10-second tube was used for the first time pause to listen to the equipment; the other delay tube has a 30-second delay and clears the robot from the telephone line.

In operation, a telephone ring momentarily closes relay No. 1 which electrically locks relay No. 2. At the completion of the ring, relay No. 1 will drop out.

Closing of relay No. 2 energizes thermostatic elements between pins 2 and 3, and after ten seconds, delay tube No. 2 contacts will close, sending 6-8v to the three pressure switches.

The signal will then sound through either the bell, the buzzer, or the high frequency buzzer, depending on pressure. After 30 seconds, time delay tube No. 1 opens the contacts between 5 and 7, clearing the line.

The thermostatic elements cool rapidly and the system automatically resets for the next call.

With closely-set differential switches, accurate reports are possible with 1-ft changes in levels in reservoirs. A drop in capacity will immediately show unusual demands or large leaks.

Editor's Note: — Before undertaking the final design and installation of this useful system, it is advisable to discuss it with your local telephone company. Individual company regulations vary with respect to connections to telephone equipment.

QUESTIONS AND ANSWERS

Answer to No. 522

How Prevent Pulverizer Explosion?

Prevent ignition—Hartmann

BUREAU OF MINES Report of Investigations 3924, Effect of Relief Vents on Reduction of Pressures Developed by Dust Explosions is out of print, but a revised more up-to-date publication on this subject is in preparation at this time. Most of the essential information from R.I. 3924 is contained in an article I wrote on "Pressure Release for Dust Explosions," and which was published in the *National Fire Protection Quarterly*, volume 40, July 1946, pp. 47-53.

Safeguards for the prevention of explosions in coal pulverizers and other equipment are discussed in the codes for the installation of pulverized coal systems and for pulverized fuel systems, published by the N.F.P.A. Pertinent information is available in the N.F.P.A. pamphlet "Fundamental Principles for the Prevention of Dust Explosions in Industrial Plants," and also in the Bureau of Mines Bulletin 242 on "Explosion Hazards from the Use of Pulverized Coal at Industrial Plants." Although prepared many years ago, most of the recommendations and suggestions in the Bulletin are still highly pertinent to the problem that you have raised.

We know of no satisfactory device that will detect dangerous coal-air mixtures, and it is doubtful that such an instrument would be of much help in the situation mentioned. The lower explosive limit of finely-divided bituminous coal dust in air is approximately 0.04 to 0.05 oz per cu ft, and the upper limit is of the order of 10 to 15 oz per cu ft. Under some conditions, it may be even higher. It is unlikely that during some parts of an operating cycle the dust concentration in equipment will not pass through the explosive range. The most important single safeguard against ignitions and explosions is the elimination of all potential sources of ignition. This includes open lights, overheated bearings or other hot surfaces, electrical sparks of static or other origin, frictional or metallic sparks due to tramp iron or *continued on page 100*

EASY TO SERVICE...

a plus value of ASHCROFT *Maxisafe* DURAGAUGES

Turn the knob on the back of the *Maxisafe* and the plate comes off, fully exposing the entire mechanism for fast and easy inspection, recalibration or adjustment. This time and money-saving feature is highly favored wherever Ashcroft *Maxisafe* Duragauges are in service.

This Duragauge was named *Maxisafe* because it has an integrally-cast wall to separate the dial from the movement and Bourdon Tube assembly — a solid wall of safety that protects the viewer if the tube ever ruptures. Covering the back of the case is a double spring mounted safety release plate — a Teflon-coated plate tightly fitted on a rubber gasket and held in place by a knurled knob. Less than 0.5 psi pressure created by a ruptured tube forces this cover open — vents the discharge safely to the rear.

The Maxisafe is available in 4½", 6" and 8½" dial sizes. You can have a choice of standard Ashcroft Duragauge pressure ranges, case designs (except Types 1179 and 1279), and mountings. Get the utmost in sustained accuracy, durability, protection and convenient servicing. Specify Ashcroft *Maxisafe* Duragauges.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR has complete facts about Ashcroft Gauges of all types. You can depend on his knowledge and experience to help you satisfy every requirement of the application. He maintains local stocks to serve you promptly and economically.

1850 ASHCROFT U.S.A.

ASHCROFT GAUGES

MAXWELL MANNING MM&M TRADE MARK

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

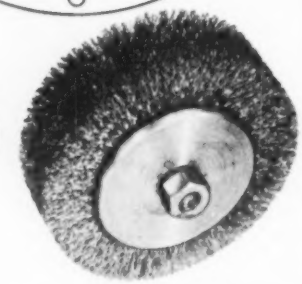
MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

For more data circle 547 on Post Card

ROTOJET®
Tube Cleaners

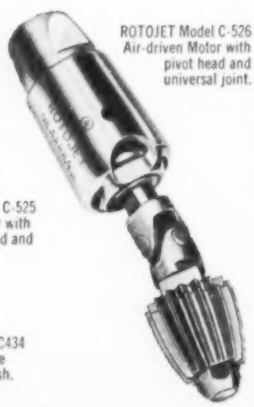
Clean tubes and pipes from ½" to 12" I.D. THOROUGHLY QUICKLY

ROTOJET Model 512 Air-driven Motor, universal joint, swing-frame head, and solid brush.



Our large stock of Rotojet air-driven and water-driven tube cleaners, accessories, and repair parts for straight and curved tubes, pipes, and transfer lines is available to meet most requirements without delay. Tube cleaner specialization for 43 years assures satisfactory results from any Rotojet equipment we recommend. Send for Bulletins J-410 and R-105. For quick action wire or phone, HUmboldt 3-0570.

ROTOJET Model C-526 Air-driven Motor with pivot head and universal joint.



ROTOJET Model C-525 Air-driven Motor with swing-frame head and universal joint.

ROTOJET Junior Model S32 Air-driven Motor, universal joint, cone cutter.

ROTOJET Junior Model C434 Air-driven Motor, flexible coupling, expanding brush.

ELLIOTT COMPANY-ROTO DIVISION

147 Sussex Ave. Newark 1, N. J.

For more data circle 551 on Post Card

any number of other possible causes, and other forms of energy. This safeguard, coupled with good housekeeping, should eliminate most of the difficulties. Suitably installed explosion vents will not prevent explosions, but they will reduce damage from accidental explosions.

IRVING HARTMANN
Pittsburgh, Pennsylvania

Answer to No. 520

How to Avoid Undue Noise in Air Ducts?

Isolate, Calculate, Integrate—Burns

FOR POWER STATION ventilation and heating, I have used design air velocities of 2800–3000 fpm at the fan discharge, with the velocity dropping to about 2000 fpm at the outlet farthest from the fan in lengthy systems. Velocities as high as 4000 fpm have been used at the fan discharge where the connecting ductwork was very short. Use of these values has not given rise to noise problems when the systems were properly balanced in accordance with the design operating conditions. Air conditioning system ducts for power station control rooms have been designed for velocities of 1500–1600 fpm and have given low noise levels.

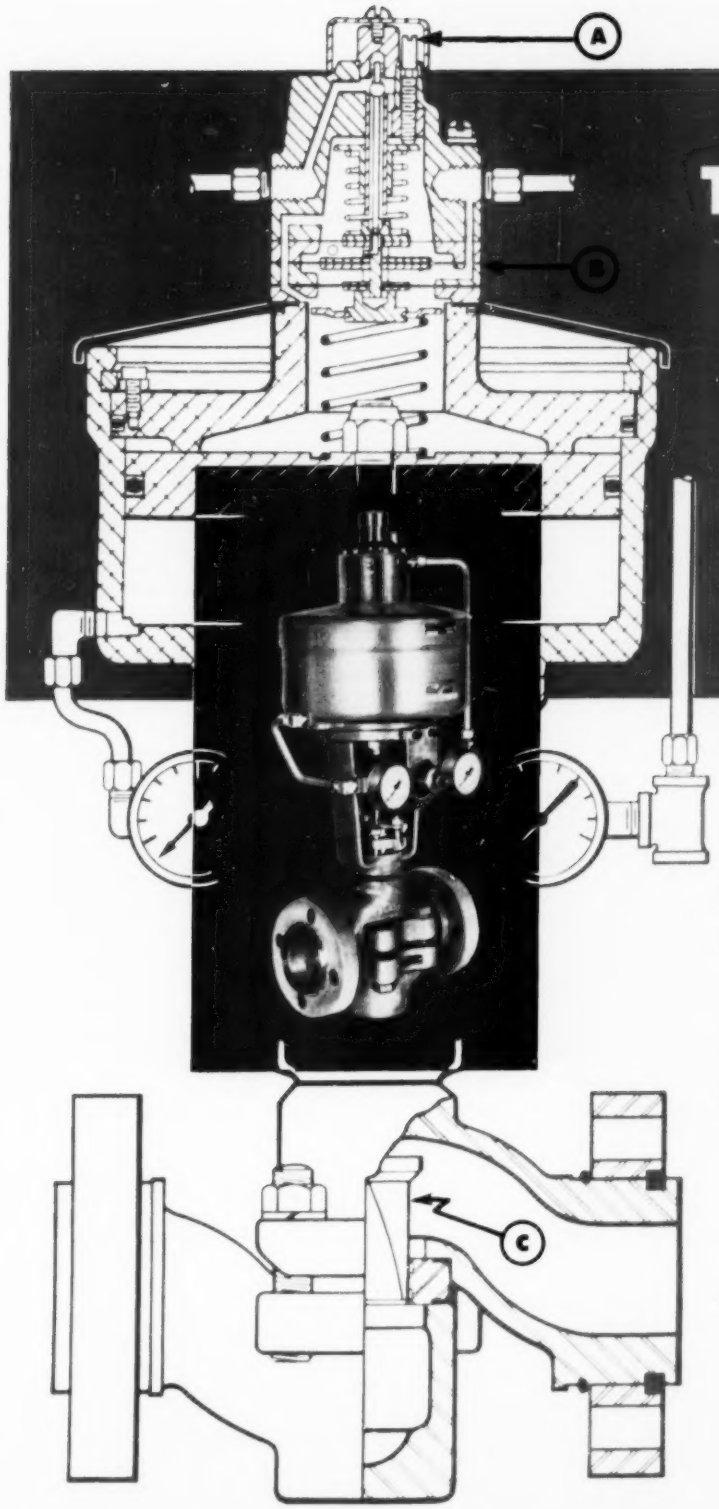
In the above cases, the ducts carrying high velocity air have been stiffened to prevent vibration and have been constructed of fairly heavy gage (18) material.

Although the velocities noted have been employed for power stations, general industrial building practice possibly would call for recommended velocities in the order of 1200–1800 fpm for main ducts, 800–1000 fpm branch ducts, and 800 fpm for branch risers.

Some noise reduction in existing systems has been effected by lining the inside of ducts at the discharge of the fan with accoustical material and by introducing an expansion chamber or a change in area in the ductwork. Reference is made to the *Heating, Ventilating and Air Conditioning Guide* for further information on duct treatment for sound absorption.

In conclusion, if proper care is taken in selecting fans, motors and their mountings on the basis of quiet operation, isolating the connecting duct from the fan by means of an expansion joint, keeping conduit and piping from contact with the fan housing, constructing the ducts of heavy-gage materials and stiffening them properly, then keeping all air velocities reasonable — no noise problems should be encountered.

W. J. BURNS
Westbury, L. I., New York



TOPWORKS THAT MAKES THEM "TOPS"

CONOMOTOR Series LB CONTROL VALVES

Ingenious pneumatic piping arrangement and exclusive positioner design, permits opening or closing of valve on air failure with either direct or reverse action Conoplug.

Most control engineers agree on the advantages of *single-seated* valves for today's demanding process applications. But in order to successfully operate single-seated valves it is necessary to have better than average topworks . . .

Hence, the revolutionary CYLINDER CONOMOTOR. . . . 10 to 20 times more POWER than conventional spring motors . . . SPEED of response 5 to 10 times faster than diaphragm motors . . . 50% reduction in WEIGHT per unit of delivered power . . . 30% reduction in SPACE requirements . . . STABILITY and positioning ACCURACY unmatched by conventional spring-and-diaphragm or springless diaphragm motors.

The combination of the Cylinder Conomotor with the unique single-seated split body gives industry, for the first time, a fully coordinated valve design. Conomotor Series LB Control Valves meet *all* of industry's rigorous requirements.

WRITE FOR CATALOG LB-1.

CC401

Conoflow Controls

CONOFLOW CORPORATION

FOREMOST MANUFACTURERS OF FINAL CONTROL ELEMENTS

2100 ARCH STREET, PHILADELPHIA 3, PA.

For more data circle 548 on Post Card

NATIONAL AIROIL

OIL BURNERS

of the steam and mechanical types now combined into

DUAL STAGE BURNERS

PATENT PENDING

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

41 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL HEATERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS

NATIONAL AIROIL BURNER CO., INC.

1268 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
Southwestern Division: 2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

For more data circle 549 on Post Card

Unit Heater Maintenance

continued from page 67

may be reshellacked and worn wiring repaired or replaced. Starting switches may be checked for proper operation.

Maintenance work on the heater fan consists mainly of cleaning the fan blades. This is an important item as excessive accumulations of dirt and dust on the blades may cause vibration and unbalance with resulting damage to the bearings.

Control equipment consists of line breakers, thermostats and limit controls. It is essential that all current-carrying contacts on these devices be clean and have proper contact pressure. The frequency of maintenance of control equipment will vary according to the location and condition of the atmosphere; however, weekly inspection is recommended during the heating season. Thermostats should be protected against tampering by unauthorized persons. In providing this protection care must be taken to insure proper operation of the thermostat. Limit controls play a very important part in the operation of the unit heater, as they guard against hazardous operating conditions and excessive or below normal building temperatures. A heating contractor or control manufacturer should be consulted before installing limit controls for specific purposes.

Duct Work

This category of maintenance work includes the duct work that is used to convey outside air to the heater inlet, and also the louvers, fan guards and heater casing. Both the interior and exterior surfaces of these components should be cleaned and if necessary painted at yearly intervals. Large ducts are usually provided with man-size access doors, and work on the interior surface may be performed on the inside of the duct. Small duct work which does not have such means of access may be cleaned from the outside; however, this operation requires the use of high-pressure air and spray guns. Signs, warning pedestrians of cleaning operations, should be placed near the duct intake entrance. All holding bolts and attachments on the fan, fan guard, louvers and heater casing should be inspected for tightness. Inadequate maintenance of the metal work can result in corrosion and possible failure of the metal which will cause air leaks and affect the operation of the heater.

Maintenance, Service Records

A complete record of all inspections, heater breakdowns and material replacements, is an essential requirement for any unit heater maintenance program. Figure 3 shows forms that may be used in compiling these data.

It is recommended that each heater be assigned a number or other form of identification. This will aid in lo-

Con Edison specifies "K" Monel pump shafts for New Astoria Station

At their first all-new plant in 25 years, the Consolidated Edison Company means to take no chances with pump shaft trouble.

The Astoria Station, now under construction at the edge of New York's East River, has four single-stage vertical mixed flow pumps (each with a capacity of 68,500 gpm) to circulate water for its condensers. Made by Economy Pump Division of H. C. Wheeler Manufacturing Company, *all four pumps have "K" Monel shafts, as specified by Con Edison engineers.*

They singled out this rugged shafting material for several important reasons. For one thing, they knew "K" Monel offered them excellent resistance to corrosion. This was a basic need, for water drawn from the brackish, sewage-polluted East River is highly corrosive.

They wanted, too, a shaft metal that had great strength and hardness, and high resistance to corrosion fatigue.

"K" Monel meets all these requirements. And it has the additional advantage of being heat-treatable *after* machining without undue distortion.

There's valuable information for pump users in our booklet, "*How to get longer service from your pumps.*" A copy belongs on the desk of every man concerned with the operation, maintenance or purchase of pumping equipment. The booklet will be sent promptly — without cost or obligation. Write for it — *today.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys INCO

MONEL® • "R"® MONEL • "K"® MONEL "KR"® MONEL • "S"® MONEL • INCONEL® INCONEL "X"® • INCONEL "W"® • INCOLOY® NIMONIC® Alloys • NICKEL • LOW CARBON NICKEL DURANICKEL®

One of four. Workmen lower a "K" Monel shaft into a giant SAFV Wheeler-Economy pump at Con Edison's new station in Astoria, N. Y. This shaft is 6 inches in diameter, 27½ feet long, and weighs 1,900 pounds. It has a minimum Brinell hardness of 265. In operation, the pump, with a total dynamic head of 16 feet, will be driven at 233 rpm by a 400-hp motor.

For more data circle 550 on Post Card

EYE-HYE, the original remote reading gage, assures perfect measurement, dependability and clear reading of liquid levels — at a safe convenient distance from boilers and other vessels.

Models available cover every liquid level variation requirement — every working pressure up to 2500 psi. All models feature the distinctive illuminated green indicating fluid except a mercury type designed for storage tanks having 8 to 12 foot level variations.

And all models (except the mercury type) can be equipped to actuate additional signals — lights or horns — which warn operators when dangerously low or high levels occur.

Write for Bulletin CO and learn how EYE-HYE can increase the reading efficiency of all your liquid levels.

The Reliance Gauge Column Co.

5902 Carnegie Ave., • Cleveland 3, Ohio

For more data circle 560 on Post Card

Unit Heater Maintenance

continued from page 102

cating the unit when reporting trouble. A card containing the service record on one side and the check list on the other can be prepared for each heater and filed. The maintenance personnel should be instructed to make complete entries on the card whenever work is performed. An efficient record system will not only serve as guide in establishing replacement, depreciation and other cost factors, but will furnish valuable information that can be used in correcting local problems or in modifying the maintenance program.

This article has presented an outline of a well-rounded unit heater maintenance program. In planning a program of this type, the conditions that are peculiar to the individual plant must naturally be taken into consideration.

Bad Commutation

continued from page 90

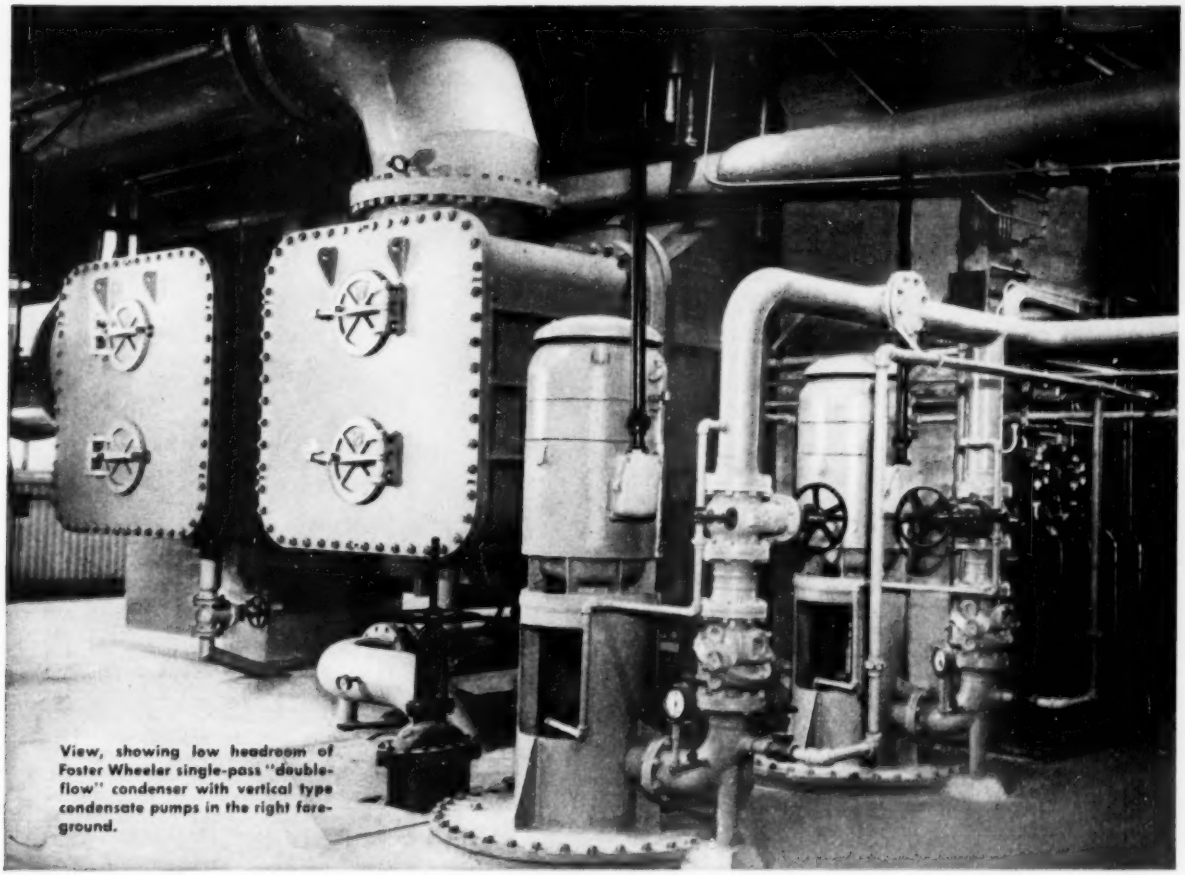
but the other area will "pick" copper from the commutator, and it will be subsequently deposited in the brush face. After a time enough copper will be present to cut through the commutator film. As soon as this occurs, the surface resistance of the film is lowered and the circulating current is many times greater. Due to the cumulative action, it is possible for a small scratch on a critical machine to develop into a serious groove within a few days.

Commutator Film

Everyone recognizes a "good-looking commutator". It has a dark brown color with a high polish. It is also well known that this film serves several very important functions. One, of course, is to provide a slick friction-free surface to the brush face. Another vital function is to provide a resistance film which limits the short-circuit current flow across the brush face. This film, of course, also presents a small voltage drop to the load current. The delicate balance between brush loading will be upset when the commutator film is destroyed by scoring. A 250-kw exciter had developed a full width groove under one brush track. Tests showed that the brushes riding on the bright track carried over fourteen times the current carried in the adjacent brushes riding on the good part of the commutator.

An interesting study was made of the development of the commutator film on a 1200-kw, 260-v generator. Brush potentials were taken at approximately the same loads. Five minutes after polishing the commutator the average voltage drop from the brush to the commutator was .62 v. Eleven days later the drop was .78 v. After eighteen days the drop was .98 v and at the end of six months

SHORTER on headroom - LONGER on savings



View, showing low headroom of Foster Wheeler single-pass "double-flow" condenser with vertical type condensate pumps in the right foreground.

New Foster Wheeler "double-flow" condenser uses 40% less headroom – cuts building costs – more than meets the highest performance standards

Utilizing a volume only 60% of that customarily required, the new Foster Wheeler "double-flow" principle marks a new advance in condenser design. Less headroom is required—often 40% less than the over-all height of conventional units. This means a proportionately shorter turbine pedestal—and a substantial reduction in building costs.

The rectangular shape makes possible complete utilization of the space available. Intimate contact and scrubbing action between steam and condensate promote effective deaeration and reheating. Condensate leaves the hotwell at steam temperature under all operating conditions. Also, because of the larger steam entrance and shorter tube-bank depth, pressure loss is reduced to a minimum. Efficient cooling of the non-condensate vapors and gases is provided by triangular cooler sections of the series zone type.

In a typical test of a 32,500 sq. ft. unit, the actual heat transfer coefficient showed 578 Btu per hr. per sq. ft. per F as against 510 for commercially clean tubes,—thus resulting in an absolute pressure 0.10 inch better than expected. Further details on request.

FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.

FOSTER WHEELER

For more data circle 561 on Post Card

Choose WESTERN
for Chemical Treatment of Water, Steam and Fuel

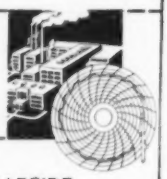
Look them over! Check your needs! Every Western product for treatment of water, steam or fuel is proved in use, technically formulated for each individual problem.

1 *Steam* + CORAVOL® = *Protection* (FROM CORROSION)

CORAVOL circulating throughout your steam system protects it from corrosive attack; cleans out rust deposits; increases heating and operating efficiency; reduces maintenance and labor costs. CORAVOL is the *original amine process* developed by Western Chemical Company.

2 WESTERN BOILER FEED WATER TREATMENT

Special formulas for each individual boiler water and operating condition to eliminate scale, corrosion and foaming.



3 COOLING WATER TREATMENT AND ALGAECIDE

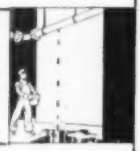
Prevents scale deposit, corrosion, and algae growth in every type of cooling and condenser water system.

4 BRINE AND SWEET WATER TREATMENT

Prevents corrosion and protects tanks and equipment in refrigerating brine and sweet water systems.

5 WESTO HOT WATER TREATMENT

Stops corrosion and scaling in hot water supply tanks and lines, maintaining service without impairing potability.



6 WESTERN LIGHTNING TREATMENT

Disintegrates and removes scale quickly from water jackets, cylinder heads, condensers, compressors, lines, coils, pumps.

7 WESTERN ALUMINA NO. 45

Provides efficient coagulation in raw water ice manufacture, lime and soda softeners, water supply clarification.

8 WESTERN SOOT REMOVER

Removes and prevents soot deposits in combustion areas, thus increasing fuel economy and boiler capacity.

9 WESTERN FUEL OIL SLUDGE DISPERSANT

Eliminates sludge and moisture in fuel oil, effecting clean tanks, lines, and burners, and improved combustion.

Chemical Treatment for Water Steam and Fuel

WESTERN CHEMICAL COMPANY

717 Washington Street
Kansas City 5, Missouri

MAIL THIS COUPON TODAY

Western Chemical Company
717 Washington Street
Kansas City 5, Missouri

Send me full information about products checked.

[1] [2] [3] [4] [5] [6] [7] [8] [9]

Name

Firm

Address

City Zone State

For more data circle 562 on Post Card

Bad Commutation

continued from page 104

the average value was 1.72 v. At this six month's period, the commutator was subject to grooving and burning.

It has been the Department's experience that all brushes do not build up the same commutator films, some overdo the job. After a period of service, the thicker, gummier films break through with resulting scoring. The color of the film is not important and may vary from a light straw color to jet black, usually a chocolate brown. The important thing seems to be that the surface should be of a hard glass-like texture reflecting objects like a mirror.

Importance of Alignment

The usual corrective work to improve commutation on a 300-kw generator was only partially successful. The machine unbalance was such that it could be felt in the brush rigging. The generator was dynamically balanced and the reduction in vibration allowed the earlier work to become effective. This unit has now run for years and has developed a good commutator polish.

Two carrier motor generator sets overhauled in the Electrical Repair Section operated perfectly on test. A short while after installation, they were reported in trouble. Investigation disclosed that the installation crew had distorted the fabricated bases by pulling them down on uneven concrete piers, causing severe vibration. Reconditioning the commutators and installing the sets on cork pads eliminated the vibration. The resulting years of trouble-free service emphasize the importance of establishing good balance and good alignment.

Resistance in Risers

A 750-kw generator had been given the full treatment. The unit was overhauled, set on running neutral, adjusted for commutation by black band testing and a new set of brushes installed. Although this work did improve the commutation considerably, it still left something to be desired. If the brush rigging was not cleaned every thirty days, the brushes would start sparking. The risers were suspected and resistance measurements were made but no appreciable variation could be detected.

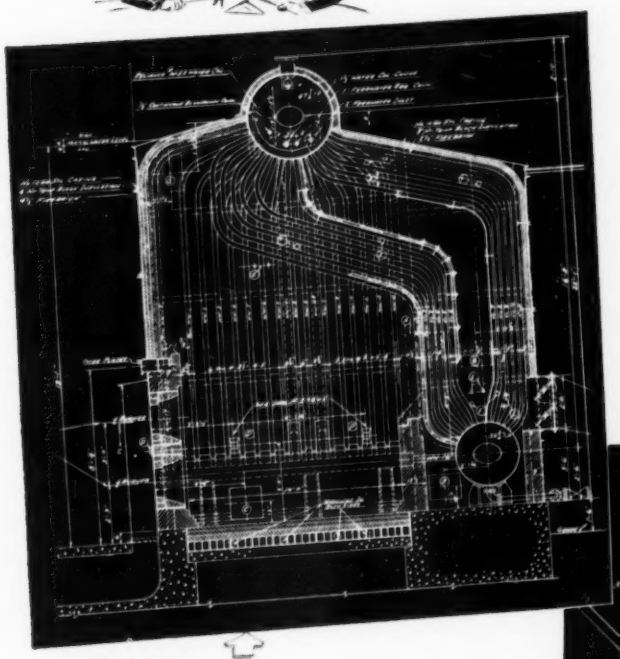
In 1947 while carrying an above normal load, the machine suddenly started sparking and snapping. Investigation disclosed one clip on a commutator riser had opened up. This clip had never been tinned before it was soldered and only 25 per cent of the area was joined with solder. An interesting thing was that the previous burning was all on one-quarter section of the commutator, but during the time it ran on the open clip, burning was as expected on three equidistant bars, 360 electrical degrees around the commutator. The clip was re-soldered and the commu-

Industry Approved

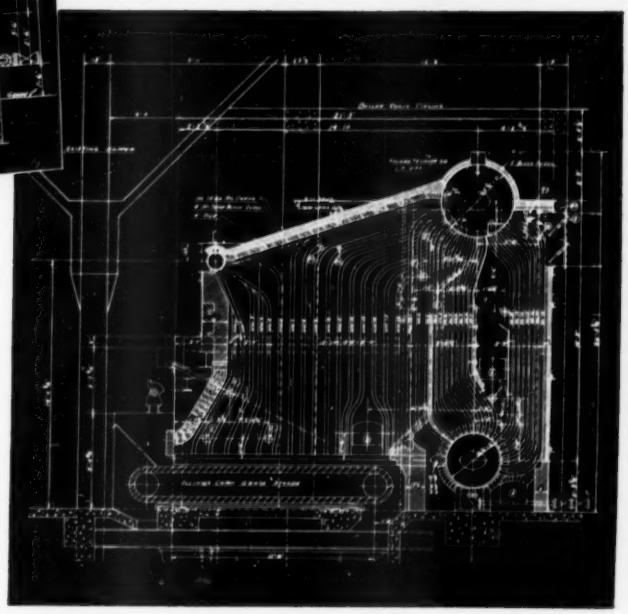
Two-Drum

STEAM GENERATORS

by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 30,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS

DISTILLERIES • HOTELS

HOSPITALS • CHEMICAL PLANTS

PETROLEUM REFINERIES

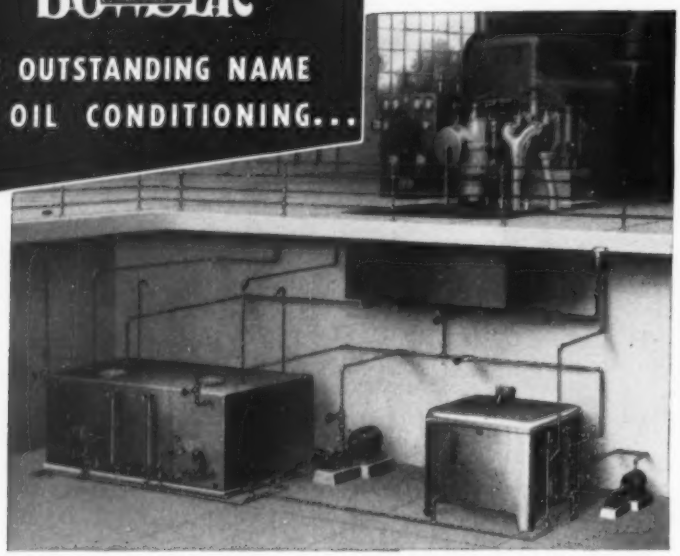
HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

For more data circle 563 on Post Card

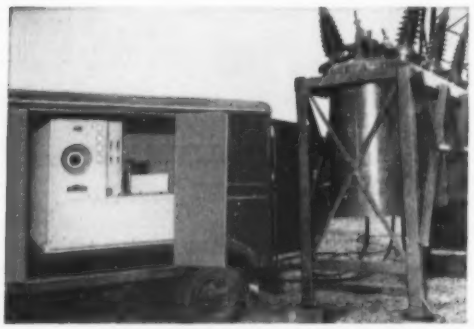
BOWSER

THE OUTSTANDING NAME IN OIL CONDITIONING...



...for power generating equipment!

This Bowser turbine oil conditioning system keeps oil "bone dry" and crystal-clear . . . the best "stay-on-the-job" insurance a turbine bearing can have. Costly bearing failures are avoided and less stand-by equipment is required with Bowser oil conditioners. Turbine oil lasts for years, too! That's why Bowser oil conditioners are on the job in a majority of power plants.



...for insulating oils!

The Bowser Hydro-Volifier is a conditioning unit for transformer, circuit breaker and switch oils. It restores oil dielectric to 35 k.v. in a single pass while the equipment remains energized . . . no service interruptions with Bowser oil conditioning!

BOWSER

may we send you complete data?

BOWSER, INC., 1351 CREIGHTON AVE., FORT WAYNE 2, IND.

Regional Offices: • Atlanta • Cleveland • Dallas • Fort Wayne • Kansas City • New York • San Francisco • Washington, D. C. • Canadian Plant and Sales, Hamilton, Ont.

For more data circle 564 on Post Card

Bad Commutation

continued from page 106

tator developed into one of the best of the system.

Trailing Edge Sparking

A 1200-kw machine developed into an interesting project. We progressively made all of the adjustments normally required. The machine was overhauled, set on running neutral, and compensation adjusted by the black band method. In spite of the fact that the load neutral was perfectly located at all loads and the current distribution to the brushes was very good, as determined by the brush potential reading, the machine did the following: For the first month or so the commutation on the newly polished commutator was black at all loads, but then a slight sparking would appear on the trailing edges of the brushes. After a few days the sparking would become so vicious that the machine could not carry over 25 per cent load.

This was an unusual condition and inasmuch as the machine had been given the full treatment, we felt there was something involved which was not detectable with the usual equipment. It was decided to try an oscillograph and wave analyzer on the machine to see what could be found.

Air Gaps

The a-c voltage in the d-c armature was picked up on the balance coil rings. We noted this sine wave had a fuzziness on the peaks. See Fig. 2. Blowing up this section of the peaks, and analyzing it on the wave analyzer, we found ripples of 5.4 v rms corresponding very closely to the armature slot frequency. See Fig. 3A. At this time the field pole air gaps were only 153 thousandths of an inch, which is rather close for such a large machine.

At one time the air gaps were reduced 10 per cent for better pole face compensation. Although this improved the brush face potentials, it was more difficult to obtain lasting commutation. It was suspected that the close air gap was responsible for the high value of the ripples. The air gaps were then increased to 297 thousandths of an inch.

Effect of Air Gap

After a period of time, the oscillograph and wave analyzer were again applied to the machine and it was found that doubling the air gap reduced the ripple from 5.4 to 1.5 volts rms. See Fig. 3B.

The ripple frequency checked very closely to the armature slot frequency and is presumably caused by the slot teeth abruptly entering and leaving the field flux.

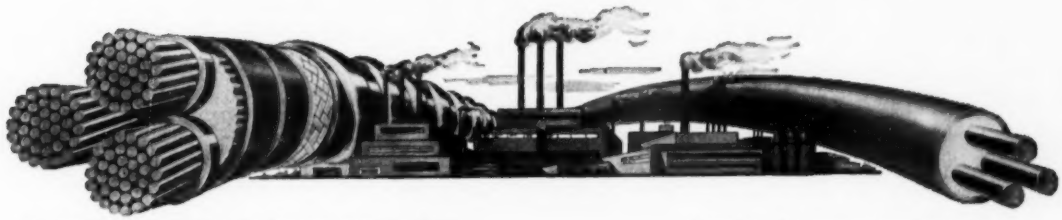
Increasing the air gap greatly improved the commutation of these 1200-kw generators. Needless to say, air gaps are now seriously considered in analyzing commutator troubles.

GENERAL CABLE

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

POWER TWINS

...Newest, Most Practical Team for Plant and Equipment Wiring



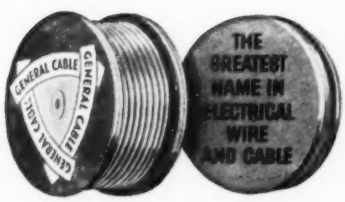
VARNISHED CAMBRIC OR RUBBER INTERLOCKED ARMORED CABLES

SAFETY m. i. WIRING SYSTEMS

The famous Power Twins combine lower installed costs with unique adaptability. They are ideal for electrical wiring without conduit in close areas and under, down and around beams and pillars...where power needs vary... where plant layout presents difficulties.

Varnished Cambric or Rubber Interlocked Armor Cable is designed for both low and high voltage requirements, (lighting and power control) and is available with steel, bronze or aluminum armor.

Safety m.i. Wiring System, all mineral insulated and exclusive with General Cable, is ideal for all applications up to 600 v. where heat, vapors, moisture, aging are of particular concern. Lower installed cost! Small diameter saves space! Trains easily for neat, compact installation. Investigate this popular combination before you buy. They can save you time and money.

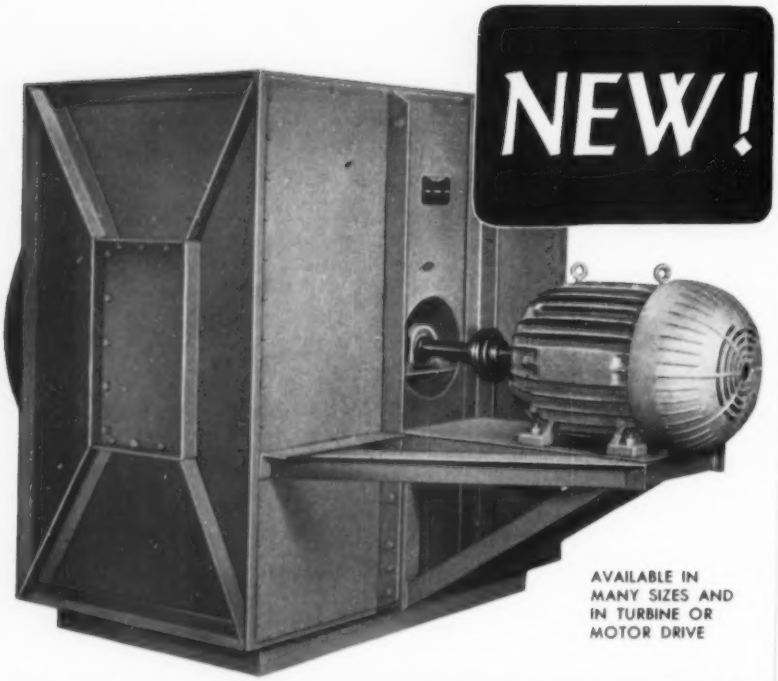


BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION

420 Lexington Avenue, New York 17, New York • Sales Offices: Atlanta • Buffalo Cambridge (Mass.) • Chicago • Cleveland • Dallas • Detroit • Greensboro (N. C.) Houston • Indianapolis • Kansas City • Los Angeles • Memphis • Milwaukee Minneapolis • Newark (N. J.) • New York • Philadelphia • Pittsburgh Portland (Ore.) • Rome (N. Y.) • Rossmoyne (Ohio) (Cincinnati area) • St. Louis San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

For more data circle 565 on Post Card



AVAILABLE IN MANY SIZES AND IN TURBINE OR MOTOR DRIVE

WING PACKAGE DRAFT INDUCER

FOR POWER PLANTS

MOTOR AND FAN DESIGNED AS ONE COMPLETE REMOVABLE UNIT

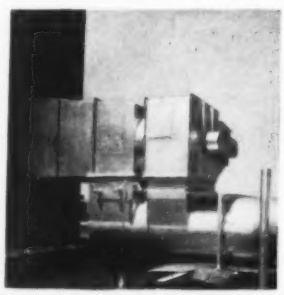
MAKES INSTALLATION EASIER

FACILITATES INSPECTION AND MAINTENANCE

SAVES SPACE

ELIMINATES WATER COOLING OF BEARINGS

INTERCHANGEABLE INLETS—TOP, BOTTOM OR SIDES



WING PACKAGE DRAFT INDUCER AT PLANT OF WELCH GRAPE JUICE CO.

Write for complete details

L. J. Wing Mfg. Co.

64 Vreeland Mills Road
Linden, New Jersey

Factories: Linden, N. J. and Montreal, Canada

OUR 75TH YEAR 1879

Wing

SEVENTY-FIVE YEARS AGO

In 1879, L. J. Wing, a resourceful inventor, founded the company that is now celebrating its 75th anniversary. Three years before, when Mr. Wing invented the Disc Fan that bore his name, General George A. Custer (above) and 276 soldiers of the 7th Cavalry were massacred at the Battle of the Little Big Horn in Montana, by Indian tribes led by Sitting Bull, the prophet.

For more data circle 566 on Post Card

More on Noise Reduction

continued from page 83

3 — Reduction Gears
4 — Exhaust Gas Systems
5 — Air-Intake Systems

D — Electrical Substation Equipment
1 — Transformers, Including Radiator Air-Cooling Fans
2 — Voltage Regulators
3 — Oil Circuit Breakers
4 — Ac-to-Dc Converter Units
5 — Frequency Changer Motor-Generator Sets

E — General Plant Equipment
1 — Heat Dissipation and Miscellaneous Equipment
a — Cooling-Tower or dry-cooler fans
b — Service-water supply pumps
c — Air-compressor intakes
2 — Electrical Equipment
a — Exciter units, geared or direct coupled
b — Motors for auxiliary drives
c — Transformers, main step-up and auxiliary step-down
d — Intercommunication, signaling and alarm systems

F — Other Facilities
1 — Control Rooms in Generating Stations Adjacent to High-Noise-Level Equipment
2 — Offices Equipped with Air-Conditioning or Mechanical-Ventilation Systems
3 — Rooms Occupied by Machine-Billing, Tabulating and Stenographic Departments
4 — Cooling Towers for Refrigeration Equipment, Used with Air-Conditioning Installations

G — Natural and Manufactured Gas Operations
1 — Pipeline Compressor Stations
a — Reciprocating-type compressors with internal combustion engine drives
b — Centrifugal-type compressors with motor or turbine drives
2 — Pressure Regulating and Meter Stations
3 — Vane-Type Blowers for Air Supply
4 — Blast from Superheater Stacks of Carburetted Water-Gas Sets

H — Construction Operations in Quiet Residential or Commercial Areas
1 — Excavating, Blasting and Pile-Driving Equipment
2 — Compressed Air Equipment
3 — Riveting Work for Structural Steel
4 — Unusual Noises During Starting-and-Testing Period, e.g., safety valves, steam vents, etc.

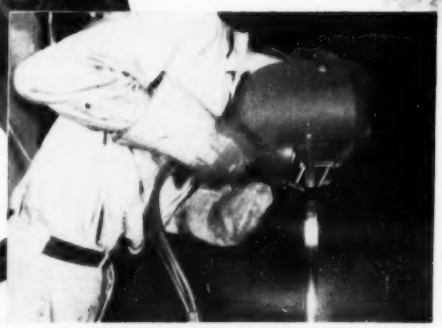
OBITUARIES

Charles F. Roth

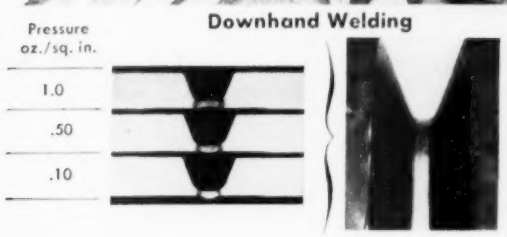
CHARLES F. ROTH, president of the International Exposition Co., and manager of the National Exposition of Power & Mechanical Engineering (Power Show), International Heating and Ventilating Exposition, and Ex-

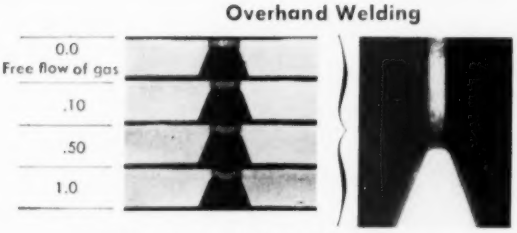
INERT GAS TUNGSTEN ARC-WELDING
ON HIGH-TEMPERATURE, HIGH-PRESSURE PIPING

It's a Standard Production Procedure at Pittsburgh Piping



Inert gas tungsten arc-weld root pass on 2¼% Chrome—1% Moly steel turbine connection for 1000° F service.





Slight variations in internal inert gas pressure make great differences in contour of root pass. Skill of operator and welding groove details are of greater importance than gas pressure.

Inert gas tungsten arc-welding is a technique which has been long and successfully applied to high-temperature, high-pressure piping at P.P.&E. Used for the first pass, it eliminates need for backing rings and double butt welding, assures full penetration and fusion, and produces a joint having a smooth inner contour that requires no grinding.

Pittsburgh Piping's process provides an inert gas shield on both external and internal surfaces of the root pass. This complete protection against oxidation results in an outstandingly uniform inside bead.

The success of the inert gas tungsten arc-welding process hinges on the welder's skill, and correct application of the many other fabricating techniques developed by Pittsburgh Piping.

Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Atlanta.....Whitehead Building	**Cleveland**...Public Square Building
Boston.....10 High Street	**Houston**...Heights State Bank Bldg.
Charlotte.....221 Builders Building	**Los Angeles**..1830 N. Alexandria Ave.
Chicago.....Peoples Gas Building	**New Orleans**.....P. O. Box 74
New York.....Woolworth Building	

PP-4

For more data circle 567 on Post Card

a Simplified System . . .

INSTROF

for the support of

INSTRUMENT TUBING

Instrof is a standard system of completely designed prefabricated Trough which may be easily laid out and quickly and economically erected at the job site to give light, strong mechanical protection and continuous support for instrument tubing.

Standard fittings include tees, elbows, risers, crosses and other items which allow any change of direction or elevation to be made easily; special pieces can be fabricated for unusual requirements. The entire system can be installed in an extremely short time to conform to almost any plant layout.

Why not call in an Instrof Engineer who will be glad to assist you in planning your installation: In the meantime write for full details—ask for Bulletin 8P.

INSTROF INCORPORATED

4923 PENTRIDGE ST.
PHILADELPHIA 43, PA.

For more data circle 568 on Post Card

OBITUARIES

continued from page 110

position of Chemical Industries, died June 24, as the result of an automobile accident.

He was born in New York in 1886. He was graduated from Cooper Union in 1912 with a degree in chemistry, and in 1915, while chief chemist for the Standard Oil Co., of New York, organized the Chemical Exposition as an aid in relieving the strategic material shortages of World War I. During the same period he served as consulting chemist for the International Filtration Corp., and director of the Beckman and Linden Engineering Corp. In 40 years, he organized and managed more than 60 industrial expositions.

Mr. Roth has been active in the affairs of the ACS since 1911 and held memberships in many other organizations, including the Chemists Club in New York, AIC, ASH & VE.

Herman Weisberg

HERMAN WEISBERG, mechanical engineer, Electric Engineering Department of Public Service Electric and Gas Co., died June 29 in the Johns Hopkins Hospital, Baltimore, Md., after a long illness. He was 54.

Mr. Weisberg was graduated from Cornell University in 1921 with a mechanical engineering degree and started to work the following year for Dwight P. Robinson and Co. of Philadelphia, which later became the United Engineers and Constructors, Inc.

He started with Public Service as planning and installation engineer, Electric Generation Department. Later, he was promoted to assistant mechanical engineer, Electric Engineering Department, becoming mechanical engineer in 1941.

Mr. Weisberg was a member of ASME, ASTM, The Engineering Foundation, New Jersey Society of Professional Engineers, the Prime Movers' Committee of the Edison Electric Institute and the Engineers' Club of New York. This past year, he was elected a Fellow of ASME. The citation stated he had made "outstanding contributions to the power-generating field."

CATALOG LIBRARY

Standard catalogs listed monthly to help you maintain a reference library

WATER CONDITIONING

201 Handbook on Demineralizing — Bulletin 5600, 39 pp, on treating water by demineralizing, explains principle of ion exchange. Discusses applications of many anion and cation exchange materials; series of curves help estimate cost of operation. Describes design and operation of demineralizer systems, multistage systems and mixed bed units. Includes curves of water quality obtainable. Cochrane Corp.

202 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

204 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, Super Nalcolite. National Aluminate Corp.

it's easy to get these free catalogs—just circle item numbers of those wanted on the post card at right.

205 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

206 Steam System Treatment — This bulletin on Coravol for prevention of corrosion, explains theory of corrosion, application of organic amines to steam systems (Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

POWER ENGINEERING
110 South Dearborn
CHICAGO 3, ILLINOIS

FIRST CLASS
PERMIT No. 353
Sec. 34.9 P.L.&R.
CHICAGO, ILL.

AUGUST, 1954
Card void in 6 months

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

Name ..... Title .....

Company Name .....

Company Address .....

City ..... State .....
(If you prefer delivery at home, give home address, too)

Home Address .....

City ..... State .....

Equipment

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33

Helpful Bulletins

101	102	103	104	105	106
107	108	109	110	111	112
113	114	115	116	117	118
119	120	121	122	123	124
125	126	127	128	129	130
131	132	133	134	135	136
137	138	139	140	141	142
143	144	145	146	147	148
149	150	151	152	153	154
155	156	157	158	159	160
161	162	163	164	165	166

Catalog Library

201	202	203	204	205	206	207	208	209	210	211	212
213	214	215	216	217	218	219	220	221	222	223	224
225	226	227	228	229	230	231	232	233	234	235	236
237	238	239	240	241	242	243	244	245	246	247	248
249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272
273	274	275	276	277	278	279	280	281	282	283	284
285	286	287	288	289	290	291	292	293	294	295	296
297	298	299	300	301	302	303	304	305	306	307	308

Advertised Products and Services

501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521
522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542
543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563
564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584
585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605

Use this space to ask for free .....
charts and other information. .....

207 **Water Treatment** — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

208 **Microbiological Control** — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan Co., Inc.

209 **Reducing Condensate Line Corrosion** — Attributing condensate line corrosion chiefly to carbon dioxide in the steam and water, Technical Paper 127 discusses various methods of minimizing boiler feedwater alkalinity, especially the use of filming amines. Cites results under various conditions. W. H. & L. D. Betz.

BOILERS, GENERATORS

211 **Shop-Assembled Boiler** — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed. Capacities, dimensions of the boilers are given. The Babcock & Wilcox Co.

212 **Packaged Boilers** — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

213 **Steam Boilers** — Form AD-100 is an 8-pp catalog providing complete description of company's self-contained boiler, hot water or steam, for heating and processing. Includes design details, capacities, dimensions and application information on boilers ranging from 15 to 500 hp and 15 to 250 psi. Cleaver-Brooks Co.

214 **Shop Assembled Boilers** — Two-drum, bent tube package units for steam and high pressure and high temperature hot water are the subject of this illustrated bulletin. Gives construction details, dimensions, ratings. Springfield Boiler Co.

215 **Improved Steam Generator** — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

216 **Steam Generators** — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cut-away

AUGUST, 1954

Circle numbers in the reader service column corresponding to numbers at ends of items you want to know more about.

POWER ENGINEERING

Please have the manufacturers named on this card send me without obligation information on literature indicated by the numbers circled below.

Name ..... Title .....

Company Name .....

Company Address .....

City ..... State .....
(If you prefer delivery at home, give home address, too)

Home Address .....

City ..... State .....

Helpful Bulletins

| Equipment | | |

G-E Motors Are Custom-built for Power Station Service!

OUTDOORS OR IN, General Electric power station motors are built to give you dependable, economical service. For example, the two vertical Tri-Clad* totally enclosed fan-cooled motors, shown here, have given consistent reliable performance under all weather conditions at the A. B. Paterson Steam-Electric Generator Station of New Orleans Public Service Inc.

GENERAL ELECTRIC'S 70 YEARS of experience in designing, building, and servicing motors for power station requirements assures you of getting the right motor for the job. Whatever your needs in power station motors, G.E. can furnish a complete line including dripproof, totally enclosed fan-cooled, totally enclosed air-water cooled, and weather protected motors in both horizontal and vertical construction.

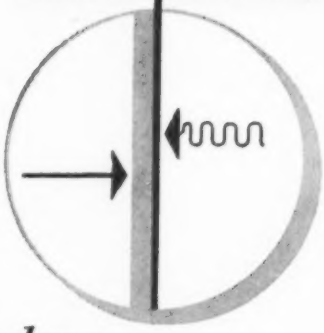
FOR MORE DETAILED information on G.E.'s power station motors, contact your nearest G-E Apparatus Sales Office. *General Electric Co., Schenectady 5, New York.* 830-1

*Registered Trade-mark of the General Electric Company

GENERAL ELECTRIC

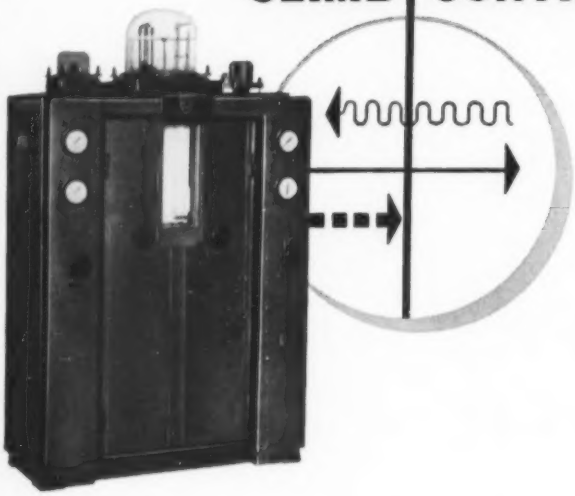
Where you need

HEAT | EXCHANGE



Be sure you have

SLIME | CONTROL



Whether you heat or cool water for make-up, process or any other use, you will need Wallace & Tiernan Chlorination to help combat slime problems introduced by water-borne bacteria or air-borne bacteria.

With slime control equipment designed for any need, built for lasting and dependable service, highly accurate and backed by over 40 years of successful application experience, Wallace & Tiernan Chlorination can help you increase the efficiency of your plant and cut operating costs. For further information write our Industrial Division.

WALLACE & TIERNAN

25 MAIN ST., BELLEVILLE 9, N. J.

CHLORINATORS • CHEMICAL FEEDERS • SCREENING EQUIPMENT • MAGNETIC SEPARATORS • PRECISION PRESSURE INSTRUMENTS • CATHODIC PROTECTION • FINE CHEMICALS

CD-39

For more data circle 570 on Post Card

illustration shows design details, and gas travel. Erie City Iron Works.

COAL, ASH HANDLING

217 **Economic Coal Storage** — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

218 **Spreader Stoker** — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous cleaning and ash discharge advantages of larger units, without need of a basement for ash removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lb of steam per hour. Detroit Stoker Co.

220 **Shredder Ring Crusher** — A crusher for coal and similar materials which features rolling shredder rings is described in this 8-pp bulletin. Gives details on a survey of 29 mines and power plants in which this type crusher is installed. Informative tables giving speed, capacity, horsepower, weight and dimensions of crushers, as well as cost data are included. American Pulverizer Co.

221 **Fly Ash Collection** — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Also describes CMP units which combine in a single installation the advantages of the Multiclone cyclonic tube with the Cottrell electrostatic precipitator. Western Precipitation Corp.

222 **Spreader Stoker Selection** — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment, and it points out many factors to be considered. American Engineering Co.

PUMPS, PUMPING

224 **Boiler Feed Pump** — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co.

225 **Controlled Volume Pumps** — Motor-driven controlled volume pumps are fully described in 40-pp Bulletin 553. Provides information on design and construction of the pumps, and includes capacity-pressure selection tables, types of capacity adjustments, standard and special designs and packaged systems. A chart shows typical applications in six major industries, and another chart, in full color, shows construction materials suitable for use with some 170 industrial fluids. Milton Roy Co.

226 **Boiler Feed Pumps** — Bulletin 109, 16 pp, illustrated in color, describes centrifugal pumps for boiler feed service. Pictures construction and major parts,

Can I use this sheet packing on hot oil lines, too?
SERVICE
Johns-Manville
SERVICE
Sure J-M Service Sheet is equally good for oil, steam and gas lines!

Your J-M Packings Distributor can tell you why this quality sheet packing has maintained such an excellent reputation for over 35 years

Where it's used: Every industrial plant can use J-M Service Sheet Packing to advantage. It's the favorite packing of thousands of plant engineers and maintenance men. Both versatile and dependable, Service Sheet makes a tight, long-lasting seal against superheated steam, air, gas, water, hot oil and ammonia, as well as many acids and chemicals.

What its advantages are: J-M Service Sheet is a quality packing, made of selected long-fibre asbestos bonded with heat-resisting compounds. It is graphited on one side to permit breaking a joint without destroying the gasket. The ungraphited side is ruled into one-inch squares to speed cutting and reduce waste. And . . . you can order it in large economical quantities because J-M Service Sheet will not dry out in stock!

How it is furnished: Service Sheet is supplied in sheets 54″ x 63″, 36″ x 126″, 36″ x 63″, and 54″ x 126″ sheets in thicknesses of 1/64″ to ¼″ and 108″ x 126″ sheets in thicknesses of 1/32″ to ¼″. It is also furnished as cut gaskets in standard and special shapes. See the J-M catalog for further details.

Your J-M Packings Distributor carries complete stocks of J-M Service Sheet and other quality Johns-Manville Packings. He can help you choose the right packing for your application. Write him for complete information and copy of folder PK-19A, "Thousands of Plants Rate It Tops." Or address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

For more data circle 571 on Post Card

BIDDLE *Instrument News*

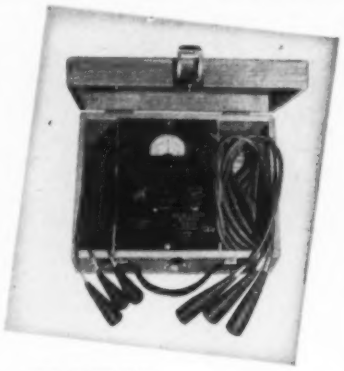
MOTOR ROTATION and PHASE TESTER

For determining:

. . . Direction of rotation of electric motors before they are connected to the line.

. . . The phase rotation or sequence of energized power circuits.

Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.



for **BULLETIN 80-PE**

FAMOUS Dr. HORN *HAND TACHOMETER*

Many consider Dr. Horn to be the finest speed measuring device obtainable. Gives instantaneous readings of rotational—or linear and peripheral speeds—regardless of the direction of rotation. Measures 6 ranges from 25 rpm to 30,000 rpm. Operates with equal precision in vertical, horizontal or slanting position. Simple mechanism. Overspeed protection. Low maintenance. Long life. James G. Biddle Co. is sole U.S. distributor.

Write for **BULLETIN 35-65-PE**

TWO-IN-ONE JAGABI® *TACHOSCOPE*

Combines speed indicator and stop watch. Replaces "human element" of error in starting and stopping with higher accuracy of calculation because Tachoscope can be operated for longer period. High precision instrument for measuring machine speeds up to 20,000 rpm. Frequently used as a standard for checking other speed measuring instruments. The high quality stop watch may also be used independently.

SPEED MEASURING BULLETIN. A selection chart of Speed Measuring Instruments for specific conditions is a feature of BULLETIN 35-PE.

JAMES G. BIDDLE CO.

ELECTRICAL TESTING INSTRUMENTS

•

SPEED MEASURING INSTRUMENTS

•

LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET, PHILADELPHIA 7, PA.

James G. Biddle Co. 9-420
1316 Arch St., Phila. 7, Pa.

Gentlemen:
Please send me material checked:

☐ 80-PE ☐ 35-65-PE ☐ 35-PE

NAME

JOB FUNCTION

COMPANY

ADDRESS

For more data circle 572 on Post Card

floating seal incorporated. Capacity data included. Pacific Pumps, Inc.

FUEL OILS, LUBRICANTS

227 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to speed is covered. A chart shows relation of engine performance to fuel properties. Sinclair Refining Co.

229 Turbine Oil Conditioning — Bulletin 832-P, 12 pp, offers a detailed explanation of the reasons for turbine oil conditioning, the way in which company's dry type conditioning equipment nullifies or prevents factors which promote deterioration of oil. Bowser, Inc.

230 Petroleum Pitch — This illustrated article on petroleum pitch as a boiler fuel stresses its low cost, other advantages. Explains combustion of pitch; discusses unloading method, burning, storage, fuel oil treatment, also precautions in handling hot pitch. Kor Corp.

231 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

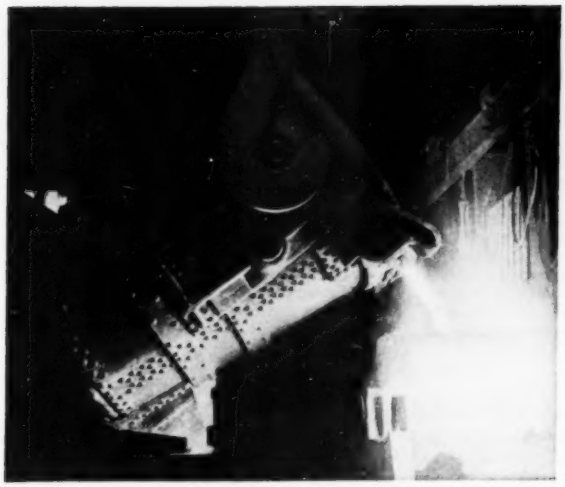
232 Compressor Lubrication Problems — Vol. 40, No. 1 of Lubrication provides a 14-pp article on problems associated with compressor lubrication. Reviews compressor types, function of the lubricant and importance of adequate installation. Air compressor explosions and receiver fires are discussed, as are condensation and compressor cooling, bearing lubrication, selection of lubrications. Special problems of air, gas, refrigerator, and other compressors are treated. Includes lists of factors which control dependable compressor operation; those which may react against efficiency. The Texas Co.

233 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, also safety precautions. Cities Service Petroleum, Inc.

ELECTRICAL EQUIPMENT

235 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither text book nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control. Allis-Chalmers Mfg. Co.

236 Motor Lubrication — Three methods of lubricating electric motors — cartridge, standard open and company's



STEEL OUTPUT INCREASED BY 110 TONS PER DAY REPORTS STEEL PRODUCER: Tap-to-tap time reduced from 18 to 12 hours . . . Fuel cut 46% per ton produced . . . Tonnage up 50% daily! That's the job Cities Service Heat Prover helped perform for one of the largest steel producers.

"COMPLETED 30 HOUR TEST IN JUST 6 HOURS!" "We completed what normally would have been a 30 hour test in just 6 hours," writes the Eclipse Fuel Engineering Co. of Rockford, Ill. "We found the Heat Prover equally exact, perhaps more exact than standard commercial testing equipment."

INDUSTRY REPORTS ON FURNACE OPERATION:

PRODUCTION UP, COSTS DOWN WITH CITIES SERVICE HEAT PROVER

THE CITIES SERVICE HEAT PROVER . . . Not an instrument that you buy . . . but a service we supply . . . **FREE!**

Shown above are just two of the many outstanding accounts of the Heat Prover's impressive accomplishments. Wherever a furnace operation is involved, the Heat Prover can help increase productivity by providing:

- **Rapid, continuous sampling**
- **Simultaneous reading of oxygen and combustibles**
- **Direct measurement of oxygen and combustibles**
- **Easy portability**
- **Free maintenance and re-calibration service**

Learn how the Heat Prover, supplied and maintained free by Cities Service, can benefit you. For details, contact your nearest Cities Service office or write: Cities Service Oil Company, Sixty Wall Tower, New York City 5, N. Y.

See The Heat Prover in action at the Cities Service Exhibit at the Iron and Steel Exposition, Cleveland Auditorium, Sept. 28-Oct. 1. Booths 483 and 484.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

For more data circle 573 on Post Card

Lubriflush — are compared in 8-pp Bulletin 1848. To demonstrate action of relubrication in Lubriflush bearings, a series of natural color photos of a transparent bearing housing is reproduced. Necessity of annual lubrication is demonstrated photographically. U. S. Electrical Motors Inc.

237 High-Capacity Fuses — Form HCS, 6 pp, describes fuses of unlimited interrupting capacity on voltages to 600, designed to afford protection for loads of 600 to 5000 amp. Includes test data, charts on opening time, current limiting effect. Bussmann Mfg. Co.

238 The Answers on Wiring — "20 Questions and 20 Answers on Safety m.i. Wiring" describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

239 Wire, Cable Ordering Guide — Newly-released General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords. A technical engineering data section is included. Available to qualified power engineers. United States Rubber Co.

240 Power Distribution Practices — The 28-pp "Industrial Power Distribution Idea Book" (Bulletin GEA 5900) is a guide on electric power distribution practices in large and small plants. Covers utility distribution practices; methods of buying electric power; what to do when a choice of primary voltages is available; application of primary switches and circuit breakers; types and arrangements of primary cables; and types of load-center distribution systems. General Electric Co.

241 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, dielectric absorption characteristics, and a practical method of obtaining insulation temperature. James G. Biddle Co.

INSTRUMENTS AND CONTROLS

243 Instruments for Steam Generation — Bulletin 9050, 32 pp, is a handy reference for all manufacturer's products applicable to steam generation, including electric, pneumatic, electronic and mechanical types of instruments and controls. Power engineers will find it useful in selecting instrumentation for modernization of package boilers. Minneapolis-Honeywell Regulator Co.

245 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

246 Pneumatic Valve Operator — This 8-pp bulletin explains operating principles and outstanding features of the Rotomotor positioning operator for throttling control service. Tells how this heavy duty, all-pneumatic operator is designed to combine safety and economy of air operation with the power of a gear driven screw stem. Conoflow Corp.

248 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

TUBING AND ACCESSORIES

250 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Gives details on proper installation. Scovill Mfg. Co.

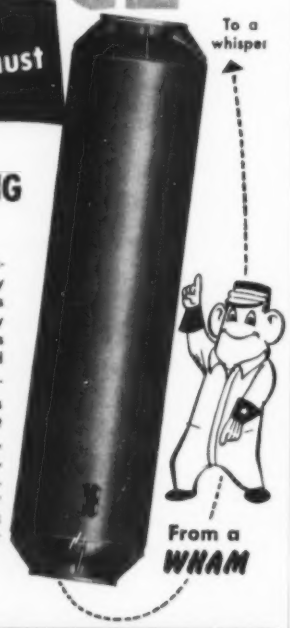
252 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

SILENCE

Those Costly Intake and Exhaust NOISES

with

BURGESS-MANNING SNUBBERS



They signal inefficient performance of your equipment and may cost you thousands of dollars annually in errors through faulty oral communications, needless nerve strain and fatigue, and result in poor neighbor relations.

Install Burgess-Manning Snubbers to scientifically silence exhaust noises from diesels, gas engines, jets, turbines, steam discharges, vacuum pumps and compressors. They offer plus values of air cleaning, heat recovery, spark arresting, surge control and water separating where required.

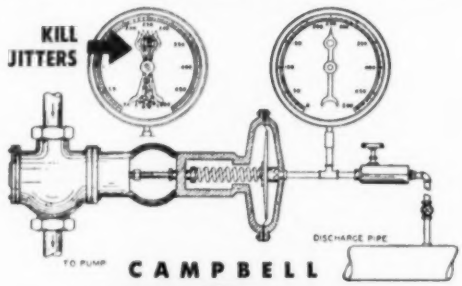
We invite you to submit your problems for recommendations —no obligation.

BURGESS-MANNING COMPANY

1767 East Park Avenue Libertyville, Illinois

For more data circle 574 on Post Card

Do your gauges shimmy?



CAMPBELL

MICRO BEAN

PULSATION DAMPENER

INCREASES GAUGE & GOVERNOR LIFE

Never install a gauge on a pulsating line without a Campbell Micro-Bean, is edict of many engineers. This miraculous pulsation dampener installed ahead of gauge and governor of a boiler feed-water pump will positively prevent fatigue of spring, rupture of diaphragm and leakage from stem packing. Smoothes out the line. Increases gauge life by ten. U. S. Army used 8000 on portable pipe lines. Most sensitive control to kill gauge jitters. ¼" and ½" to 10,000 lb. Write for literature and prices.

J. A. CAMPBELL CO.

645 E. Wardlow Rd. Long Beach 7, Calif.

For more data circle 575 on Post Card

"We repair boiler tubes a lot faster now . . . with this NEW WILSON CHAMFERING TOOL"

There's no longer any need to waste time with hand grinders or files to chamfer the ends of tubes before welding. This handy new Wilson tool (1) pilots the cutter to the tube; (2) has a taper shank which fits a standard air drill; (3) chamfers the tube edge to a 45° surface at high speed. It gives you a cleaner, stronger joint than outdated hand methods. It can also be used in boiler erection wherever several short lengths of tubing are welded together to form one long tube. Wilson also makes an inside chamfering tool for the placement of chill rings.

OTHER WILSON TIME-SAVERS for Boiler Erection and Maintenance

A Right Angle Worm Drive, used to drive expanders through handholes or from ends of headers. Made in ½", ¾" and 1" square sizes.

B Gear Train Drive available in ⅜", ½", ⅝", ¾", ⅞" and 1" square sizes.

C Extra Heavy Duty Right Angle Gear Drive, made in ¾" and 1" square sizes.

D Universal Drive Extension

E Mandrel Drive with Morse taper shank and changeabl square sockets. Available with ⅜", ½", ¾" or 1" square sockets.

Representatives in all principal cities

Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y.

Cable address: "Tubeclean" New York

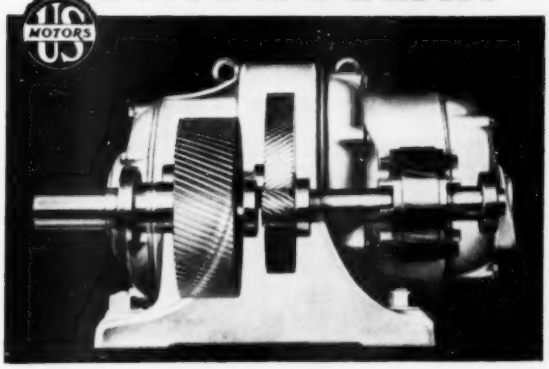
WILSON

TW 837

TUBE CLEANERS • TUBE EXPANDERS

For more data circle 577 on Post Card

Geared Power SIMPLIFIED WITH SYNCROGEAR



The motor that internally gears its speed

DON'T go to the expense of installing a gear box with extra coupling and guards to rig up slow speed for a motor. Install the *U.S. Syncrogear motor* and avoid extra contraptions. You'll simplify your power hookup, save space, eliminate hazards and give your driven machine the most efficient power. The U.S. Syncrogear motor was one of the first complete integral power units, introduced 22 years ago. It's backed by experience, tested and proved performance and engineering "know-how" that only U.S. MOTORS can offer to those seeking the most dependable geared motor power.

SYNCROGEAR ADVANTAGES

Compact—rugged—quiet
No external gear box
No extra coupling
Internally-geared
Single unit on one base
Completely housed
Reduced frictional losses
Permanently-aligned parts
Super-hardened gears
Pyramidal supporting base
Solid shank pinion
Normalized castings
Extra large oil reservoir
Asbestos-protected windings
In-a-line shaft
Neat, streamline appearance
Drip-proof surface

U.S. SYNCROGEAR MOTOR

4 TO 10,000 RPM. 1/4 TO 30 H.P.

REQUEST FOR SYNCROGEAR MOTOR BOOKLET

U. S. ELECTRICAL MOTORS INC. PE-8
Box 2058, Los Angeles 54, Calif.
or Milford, Conn.

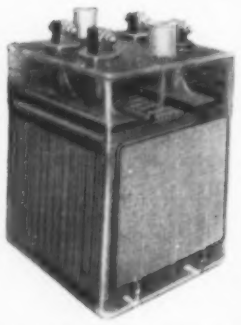
NAME _____

COMPANY _____

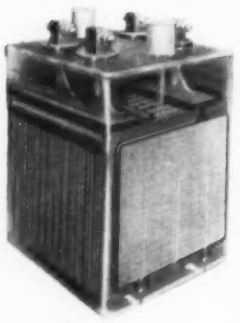
ADDRESS _____

CITY _____ ZONE _____ STATE _____

For more data circle 576 on Post Card



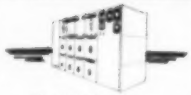
PlastiCell Type PL-29



PlastiCal Type PCL-29

NOW-2 C&D batteries for

Control



Switchgear

Auxiliary Power

Now you can have your choice of *two* modern C&D batteries—specifically designed for control, switchgear, and auxiliary power applications. The two batteries, PlastiCal and PlastiCell, are available in practically any capacity—from 10 A.H. to 770 A.H.

PlastiCal has lead-calcium grids for maximum life—conservatively engineered for 25 years in full-float service.

PlastiCell has positive plates made of high-tensile alloy grid metal for extra life and has a projected life of 14 years in float service. With both PlastiCal and PlastiCell you get:

1 **Extra-long life. Exclusive design combines advantages of both suspended and supported plate construction.**

2 **Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.**

3 **Saftee Vent—outstanding C&D development that prevents accidental battery explosions.**

4 **Crystal-clear plastic jars—heat-resistant and hermetically sealed.**

5 **Plastite Post Seals—easier maintenance.**

C&D BATTERIES, INC.

of Conshohocken, Pa.

Manufacturers of Industrial Batteries since 1906

Sales and Service Offices in Principal Cities from Coast to Coast

For Details—

Write for new C&D Specification Bulletins:

CP-536 on PlastiCal Batteries

CP-537 on PlastiCell Batteries

For more data circle 578 on Post Card

254 **Nickel Pipe and Tubes** — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

255 **Tube Cleaners** — Catalog 76-A provides 48-pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Air valves, hose, lubricators are described. Thomas C. Wilson, Inc.

256 **Rotary Tube Cleaners** — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

258 **Safety Valve Engineering Data** — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, also provides tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

259 **Check Valves** — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

261 **Valve Chart** — Form 194, 24-pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

263 **Blow-Off Valves** — Twenty-pp Catalog 12-D1 features a redesigned line of blow-off valves with flanged or welding ends and bolted bonnets for 300, 400–600, 900–1500 lb sp classes, also welded bonnet models with welding ends for 1500 and 2500 lb sp classes. Includes a discussion on "what you should know about blow-off valves," and gives tips on selection, operation, installation of blow-off valves and code requirements. Edward Valves, Inc.

264 **Lubricated Plug Valves** — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

265 **To Get at Those Valves** — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

266 **Butterfly-Valves**—Construction details, engineering and application data on butterfly valves are provided in three illustrated bulletins. Eight-pp Bulletin 557 covers those of standard heavy-duty construction; Bulletin 558, 8 pp,

SPRINGFIELD BOILERS

ANOTHER REPEAT ORDER STORY

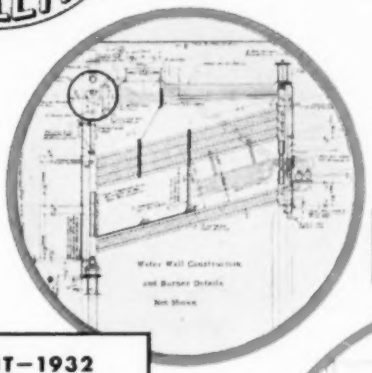
CITY OF COLORADO SPRINGS

Builds New Power Plant

SPRINGFIELD Selected for 3rd Time!

This latest installation more than doubles the City's capacity at—

1. Higher Pressure
2. Higher Temperature

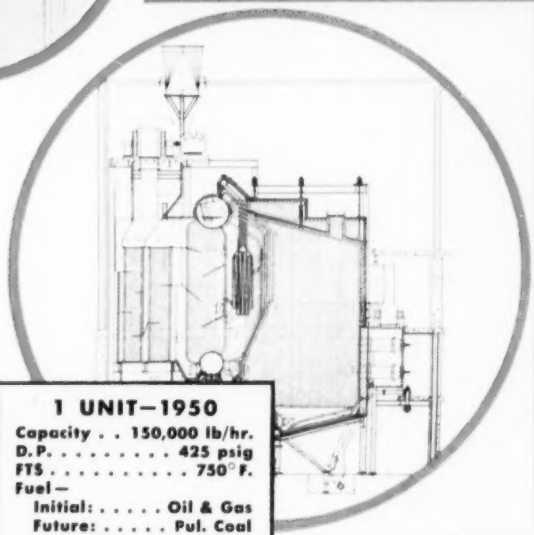


1 UNIT—1932
Capacity . . . 55,000 lb/hr.
D.P. . . . . 430 psig
FTS . . . . . 750° F.
Fuel . . . . . Gas & Oil

SPRINGFIELD PROVIDES

- Sound Engineering Design
- Superior Craftsmanship
- Reasonable First Cost
- Ease of Operation
- Low Operating Cost
- Guaranteed Performance
- Minimum Down Time
- High Efficiency

SEE SPRINGFIELD in SWEETS



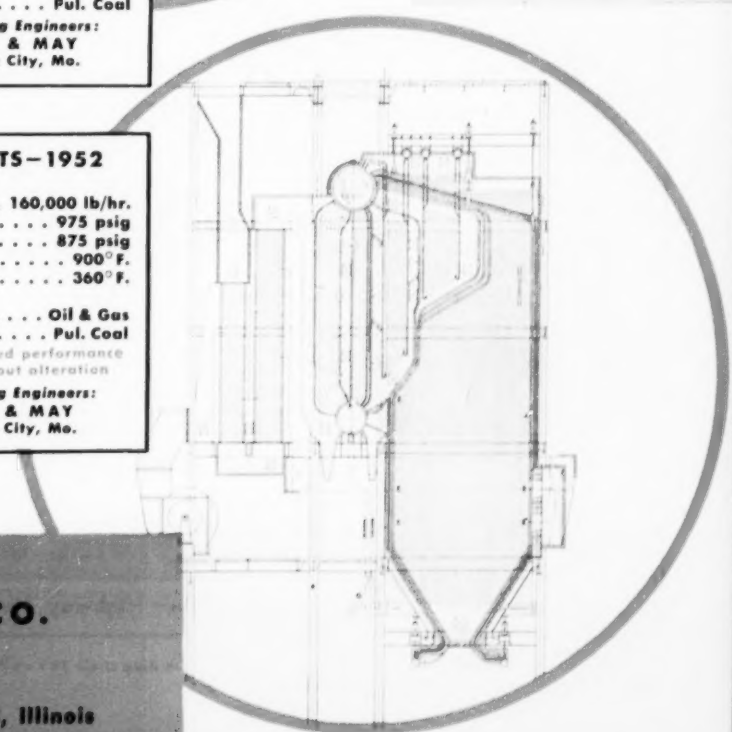
1 UNIT—1950
Capacity . . 150,000 lb/hr.
D.P. . . . . 425 psig
FTS . . . . . 750° F.
Fuel—
Initial: . . . . . Oil & Gas
Future: . . . . . Pul. Coal
Consulting Engineers:
LUTZ & MAY
Kansas City, Mo.

The City of Colorado Springs' third order for Springfield Generators gives the City a total installed capacity of over a half million pounds of steam per hour. The two latest units, housed in a new plant, are designed for 975 psig with an attemperator controlled final steam temperature of 900 deg. F., following the trend of higher pressures and higher temperature for greater overall economy.

F. H. Wiley, Supt. of Electric Div., Dept. of Utilities, City of Colorado Springs, and the Consulting Engineers are just a few of the many who have found it advantageous to "repeat with Springfield" when expanding. One large midwestern manufacturer has purchased 28 Springfield Steam Generators.

Many Consulting Engineers have favored Springfield with repeat recommendations. They always find Springfield helpful and cooperative not only in the preliminary design stage and right on through to completion, including training of the Purchaser's operating personnel, but also throughout the life of the unit.

Check with Your Consulting Engineer on Modernization and New Plant Projects



2 UNITS—1952
Capacity—
each . . . 160,000 lb/hr.
D.P. . . . . 975 psig
O.P. . . . . 875 psig
FST (Con.) . . . . . 900° F.
FWT . . . . . 360° F.
Fuel—
Initial: . . . . . Oil & Gas
Future: . . . . . Pul. Coal
All predicted performance met without alteration
Consulting Engineers:
LUTZ & MAY
Kansas City, Mo.

WRITE FOR SPRINGFIELD'S 1954 CATALOG

Worldwide Sales and Service

SPRINGFIELD BOILER CO.

FOUNDED IN 1890

DIVISION OF *John W. Hobbs Corporation*

1951 E. Capitol Avenue • Springfield, Illinois

Consult Us For:
CHIMNEYS . . .
FURNACE WORK . . .
BOILER SETTINGS

AMERICAN CHIMNEY CORP.
143 Fourth Ave., New York 3, N. Y.
BRANCHES:
BOSTON • PHILADELPHIA • CLEVELAND
DETROIT • RICHMOND, VA. • RALEIGH, N. C.

For more data circle 580 on Post Card

those of standard medium-duty construction; and Bulletin 559, rubber-lined butterfly valves. W. S. Rockwell Co.

267 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

269 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

270 Industrial Steam Traps — Twelve-pp Bulletin 853 describes steam traps with bellows of bronze, Monel or stainless steel, and bodies in bronze, semi-steel and cast steel construction in sizes ¼ to 2 in., for pressures from vacuum to 300 lb. Included besides capacity tables and dimensions are piping diagrams, typical applications, and data covering the selection. W. H. Nicholson & Co.

272 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes selection guide. Crane Co.

273 Unions and Valves — Catalog 11, 24 pp, contains full engineering data and specifications on company's Perfect Seal line of hot forged steel pipe unions and swing check valves. Also lists alloy steel and stainless steel unions, and a special section is devoted to double-start unions. Catawissa Valve & Fittings Co.

OTHER EQUIPMENT

274 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

275 Refrigerator Condensers — Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; stands for large and small condensers. Henry Vogt Machine Co.

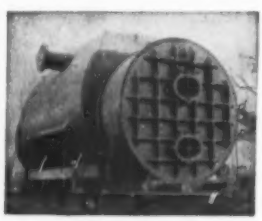
276 Turbine Speed Control — Thirty-pp wire-bound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

277 Protection Against Rust — This bulletin describes and gives applica-

STOP SLOW CURVE GO

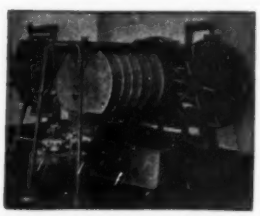
ABOVE SIGNS ARE GOOD ON THE ROAD BUT WHEN YOU WANT HEAT EQUIPMENT HERE IS THE SIGN TO LOOK FOR . . . .

CONSECO



CONDENSERS

The trade mark CONSECO on condensers, evaporators, closed heaters, refiners, filters, steam jet ejectors, deaerators and all types of heat transfer equipment is your emblem of dependable efficient equipment. Write or wire CONDENSER SERVICE & ENGINEERING COMPANY for full information on your heat problems. Write for bulletins that give you full information.



REFINER FILTERS

CONSECO Condenser Service & Engineering Co., Inc.

HO 3-4425 158 Observer Highway, Hoboken, N. J. N. Y. Tel. BA 7-0600

For more data circle 581 on Post Card

CLASSIFIED ADVERTISING

Chemical Engineer

WANTED

THE TENNESSEE VALLEY AUTHORITY needs an experienced boiler feed-water control engineer for high-pressure, high-temperature steam plants in its Division of Power Operations located at Chattanooga, Tennessee. This is a staff engineering position. Salary range, $4735-$6575, depending upon training and experience. Applicants must have a college degree in Chemical Engineering or equivalent. Retirement benefits, annual and sick leave, 40-hour week.

Write to the

Tennessee Valley Authority

Division of Personnel

Knoxville or Chattanooga, Tennessee

For Sale

320 HP UNAFLOW SKINNER, 125-135# WSP, 21" x 21" direct connected to GE, 200 KW, 2400/3/60 AC generator and,

Two 500 HP, 360 RPM, Winton diesels direct connected to Whse. 438 KVA, 2400/3/60 AC generators, complete with accessory equipment.

Village of Arcade

ARCADE, NEW YORK

HELP WANTED — MALE

Assistant to Chief Mechanical Engineer of Engineering and Contracting Company doing Industrial Piping, Plumbing and Heating in Middle West. Desire estimating experience. Give experience, education, photo and salary expectations. Box No. 1670, POWER ENGINEERING, 110 S. Dearborn Street, Chicago 3, Ill.

USE

CLASSIFIED ADVERTISING

It Pays

J. E. SIRRINE COMPANY
Engineers

Design and Supervision of Steam and Hydro-electric Power Plants, Industrial Plants, Mechanical and Operating Surveys, Appraisals • Plans • Reports

Greenville, South Carolina

GAGE GLASSES AND
High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR GAGES

ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

tion data for Z.R.C., a coating applied to iron and steel to provide a dried film protective coating of 93 to 95 per cent pure zinc. Details surface preparation, coverage, finish. The Sealube Co.

278 Power Plant Equipment — This comprehensive folder illustrates some of the equipment and services provided by this company. Shows heat exchangers, filters, condensers; also such services as re-tubing and metal spraying. Condenser Service & Engineering Co., Inc.

279 Sheet and Plate Fabrication — Illustrated in 40-pp Bulletin F-3 are products of this manufacturer, and equipment used to produce special sheet steel and alloy parts. Shows control panels, switch gear housings, cubicles and other electrical enclosures, boiler air ducts, smoke breechings, tanks. The Kirk & Blum Mfg. Co.

Postage-free cards for ordering catalogs are on pages 113–114. You may also use the cards to ask for advertised literature.

280 Dowtherm Vaporizer — Bulletin No. 48-2, describing manufacturer's Type "A" Dowtherm Vaporizer, tells how this unit is designed to evaporate Dowtherm to provide dependable operation at maximum temperatures. The Wickes Boiler Co.

281 Induced Draft Fans — Manufacturer's induced draft Bifucator fans, said to provide controlled draft for boilers and furnaces at all times, are the subject of this Bulletin DB-32-53. Illustrations, specifications and dimensions of these fans in sizes for both high pressure and low pressure boilers are provided. DeBothezat Fans Div., American Machine and Metals, Inc.

282 Automatic Soot Blowing — Bulletin 483 provides 16 pp of basic information about Vulcan automatic and automatic-sequential soot blowing. Includes a wide variety of typical installation drawings to show complete cleaning systems. Copes-Vulcan Div., Continental Foundry & Machine Co.

283 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

284 Fluid Drive — Of value to power engineers interested in obtaining adjustable speed operation in a range from 100 to 2500 hp is 24-pp Bulletin 9319, illustrated in color. Covers company's Type VS, Class 4 Gyrol fluid drive, explaining its principle of operation and illustrating its use. American Blower Corp.

285 Steam Accumulator — How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to figure capacity. Foster Wheeler Corp.

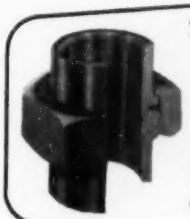
Catawissa

PERFECT SEAL

Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!



Standard & Double Extra Heavy
UNIONS

Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

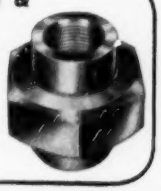
ORIFICE UNIONS

With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

FULL STAINLESS & FULL ALLOY STEEL UNIONS



With screwed or socket weld ends. 3000-lb. and 8000-lb. service.

WRITE FOR CATALOG 11
showing the complete Catawissa line of Perfect Seal Products

CATAWISSA VALVE AND FITTINGS COMPANY
400 Mill St. • CATAWISSA, PA.

For more data circle 582 on Post Card

SIMS VALVES LAST LONGER
IN ANY PUMP

Here's Why...

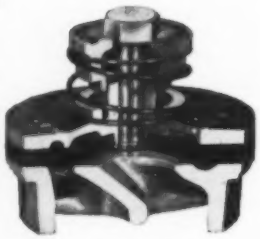
Stem breakage eliminated – by exclusive double shock-absorber stem heads.

Reduced wear – long guide gives even lift. Springs can't jam.

Smooth seating surface – rotating valve disc changes to new seating surface with every pump stroke.

Reduced flow resistance – accomplished by Sims inclined seat-ribs.

Sims Pump Valves, for all reciprocating pumps, are stocked for quick delivery.



Write for Bulletin PE-8 explaining how Sims Valves can improve your pump operation at lower cost.

Sims

PUMP VALVE CO., INC.

1314 PARK AVENUE, HOBOKEN, N. J.

M&M BLDG., HOUSTON, TEXAS

For more data circle 583 on Post Card

KOR

DOES EVERYTHING

IT'S THE MOST EFFECTIVE FUEL OIL CONDITIONER EVER MADE

KOR (pronounced "core") completely dissolves sludge; keeps the fire-side and entire fuel oil system clean, tank to stack inclusive, with no labor involved; simply by adding a few drops for each gallon of oil in the storage tank

IT'S SAFE TO USE **IT'S NON-EXPLOSIVE**

WRITE FOR BULLETINS AND PERFORMANCE PROOFS

ORDER KOR NOW—DIRECT FACTORY SERVICE

MANUFACTURERS AGENTS WRITE FOR TERRITORIES

KOR CORPORATION

Division of Oxi Corporation

MANUFACTURING, ENGINEERING, AND COMBUSTION SPECIALISTS

00 WEST 9th AVENUE, GARY, INDIANA

For more data circle 584 on Post Card

The Man Behind the Camera

continued from page 81

standard hand holder in order to give greater contrast.

If I might make some criticisms of American journalistic photography, I might say that a lot of it does not accomplish the job which it is intended to do. To my mind, it is not important that a machine operator be shown, at all costs. If the camera must be placed well back in order to show both operator and a very small piece of machinery, it would be of more value to the readers if the operator were eliminated altogether and the camera brought up close so that readers can see the details of the machine or process. Some machine-tool magazines to which I contribute material suffer from this defect. No details of the jig or tool described can be seen in the printed photograph. Some of our better British journals make a very good job of technical photography and illustrate machine set-ups and the like in a manner which is superior to a line drawing. Many of them do extensive air-brush work on the final print and label specific details with lettered arrows so that the finished photograph is an integral part of the article.

A lot of this bad technical photography could be improved by always mounting the camera on a tripod, ignoring machine operators and getting close up to the machine, use any daylight available, use flash to increase contrast only; do not be afraid of long exposures at small apertures, take meter readings and always expose as the meter indicates. Use a meter intelligently by holding it in front of a grey card propped on the object to be photographed.

Standardization of procedure is valuable. I always use the one make and grade of film and work to a standard development procedure. The developer is a liquid type and one ounce is diluted to make a film tank loading; it is used once only and then thrown away. This avoids having to make developing time corrections when using developer repeatedly.

TO THE MAN WITH POWER PLANT EXPERIENCE

build your future on what you know

DEARBORN WILL TRAIN YOU AS A SALES ENGINEER. If you are 30 or older...with several years' experience in power plant operation...and desire to improve your earnings, we want to hear from you.

Established territories now open in the East and Middle West to be filled immediately by men with practical, mechanical background. We will thoroughly train you for a responsible Sales Engineer position. Salary plus commission and expenses, plus profit-sharing, group insurance, pension plan, paid vacations and sickness benefits.

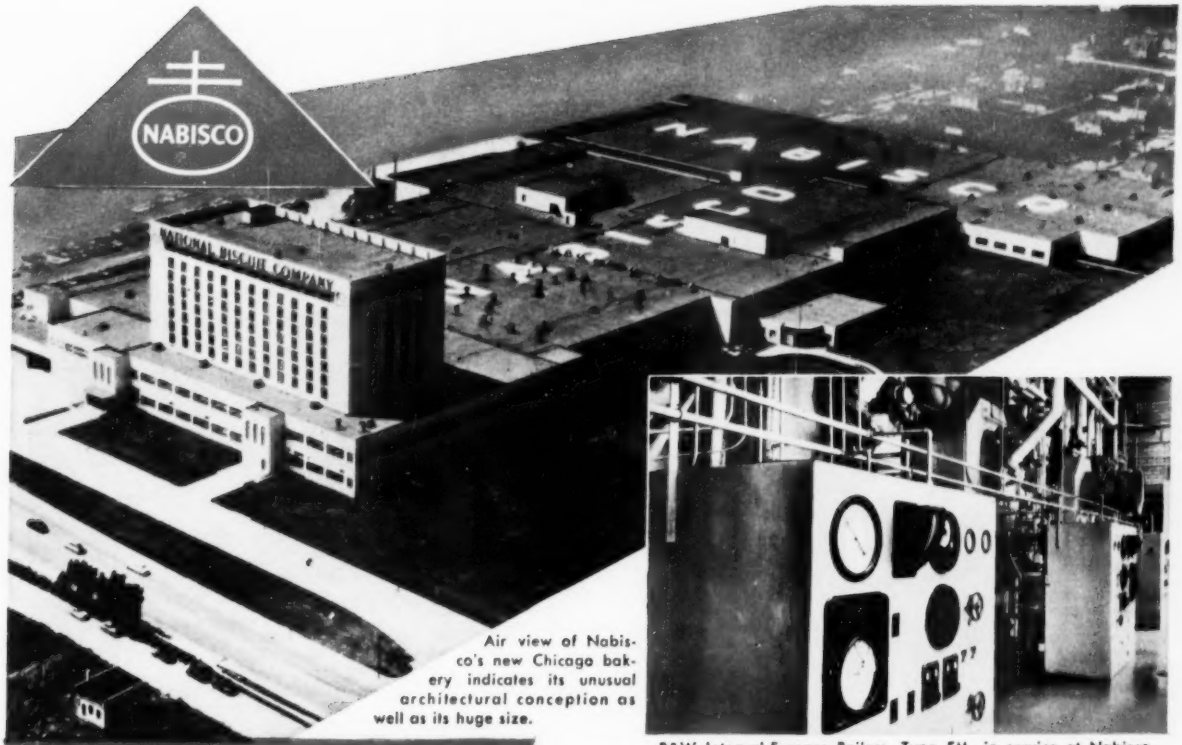
If you qualify and are interested, write or phone for a confidential interview.

Dearborn

TRADE MARK

DEARBORN CHEMICAL COMPANY • Merchandise Mart Plaza, Chicago 54, Ill. Phone: Whitehall 4-3273

For more data circle 585 on Post Card



Air view of Nabisco's new Chicago bakery indicates its unusual architectural conception as well as its huge size.

B&W Integral-Furnace Boilers, Type FM, in service at Nabisco. Delivered completely shop-assembled, FMs are ready to skid or lift into position, connect to services, and place in operation.

keeping steam cheap . . .

World's Largest Bakery

served by 3 B&W *Integral-Furnace Boilers, Type FM*

Typical of the increasing demand for the B&W Type FM Boiler was the choice of a multiple-unit installation for the largest, most modern bakery in the world, capable of producing 167 million pounds of baked goods annually. Occupying 12 acres of a 45-acre site, National Biscuit Company's new Chicago bakery is an outstanding example of scientific application of straight-line mass production methods combined with the highest standards of cleanliness and sanitation, and striking architectural beauty.

Since January 1952, the three FM units have been generating steam for heat, hot water, and various processing operations, such as melting shortening for easier unloading from tank cars and to facilitate its distribution within the plant.

Designed to produce 25,000 lb of steam per hr each at 110 psi pressure, the B&W Units are oil-fired—make a positive contribution to the elimination of smoke and fly ash required by Nabisco. Choice of the three FM boilers rather than a single, larger unit resulted after careful consideration of all factors and a realization that the FM unit offers the benefits of "package" steam combined with many cost-saving big-boiler advantages.

COST-SAVING FEATURES
of the
B&W Type FM Boiler

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

Satisfaction with the performance of the B&W Type FM Boiler is proved by the number of units in service and on order for industries, utilities, and other users in practically every category. In terms of total steam capacity they add up to about 9,000,000 lb per hr, and better than half of this capacity is in multiple-unit installations. The compact, shop-assembled FM is available in standard sizes for loads ranging from 2900 to 36,000 lb per hr at steam pressures to 235 psi—is also available for higher pressures.

Bulletin G-76A describes in detail the many cost-saving features of this self-contained, popular small boiler. Write for your copy. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.

BABCOCK & WILCOX
BOILER DIVISION

G-642

For more data circle 586 on Post Card

ADVERTISERS' INDEX

AIR PREHEATER CORP., INC. *
Agency—G. M. Basford Company
ALLIS-CHALMERS MFG. CO. 16–17, 59
Agency—Compton Advertising, Inc.
ALLIS-CHALMERS MFG. CO. (TRACTOR DIV.) *
Agency—Bert S. Gittins Advertising
AMERICAN CHAIN & CABLE CO., INC. *
Agency—Reincke, Meyer & Finn, Inc.
AMERICAN BLOWER CORP. 48–49
AMERICAN CHIMNEY CORP. 124
Agency—Brooke, Smith, French & Dorrance, Inc.
AMERICAN ENGINEERING CO. *
Agency—Beatty and Oliver, Inc.
AMERICAN MACHINE & METALS INC. 7
Agency—The L. W. Ramsey Advertising Agency
AMERICAN PULVERIZER CO. 34
Agency—Batz-Hodgson-Neuwoehner
ANDERSON, V. D. CO., THE *
Agency—Will Inc.
ARMSTRONG MACHINE WORKS 2
Agency—Russell T. Gray, Inc.

BABBITT STEAM SPECIALTY CO. 129
Agency—George T. Metcalf Co.
BABCOCK & WILCOX CO., THE 127
Agency—O. S. Tyson and Co., Inc.
BABCOCK & WILCOX CO. (TUBULAR PRODUCTS DIV.) 35
Agency—O. S. Tyson and Co., Inc.
BAILEY METER COMPANY 50
Agency—Fuller & Smith & Ross, Inc.
BALDWIN-HILL CO. 30
Agency—Eldridge, Inc.
BALTIMORE & OHIO RR. *
Agency—Richard A. Foley, Inc.
BELMONT PACKING & RUBBER CO., THE *
Agency—McNevin-Wilson-Dalldorf, Inc.
BETZ, W. H. & L. D. 97
Agency—The Michener Co.
BIDDLE CO., JAMES G. 118
Agency—The Roland G. E. Ullman, Inc.
BIGELOW COMPANY *
Agency—Emil Mark & Co.
BIRD-ARCHER CO., THE *
Agency—The Roland G. E. Ullman, Inc.
BITUMINOUS COAL INSTITUTE 130
Agency—Benton & Bowles, Inc.
BLAW-KNOX CO. 129
Agency—Al Paul Lefton Co., Inc.
BOWSER, INC. 108
Agency—Willis S. Martin Company
BURGESS-MANNING CO. 120
Agency—Merchandising Advertisers, Inc.
BUSSMANN MFG. CO. 14–15

C & D BATTERIES 122
Agency—John T. Hall & Co.
CAMPBELL CO., J. A. 120
Agency—The McCarty Co.
CATAWISSA VALVE & FITTINGS CO. 125
Agency—Charles E. Williams Advertising
CHAPMAN VALVE MFG. CO., THE Inside Back Cover
Agency—Sutherland-Abbott
CHESAPEAKE & OHIO RAILWAY 58
Agency—Robert Conahay, Inc.
CITIES SERVICE OIL CO. 119
Agency—Ellington & Company, Inc.
CLEAVER-BROOKS COMPANY (BOILER DIV.) 32
Agency—Klau-Van Pietersom-Dunlap Associates, Inc.
COCHRANE CORPORATION *
Agency—John Falkner Arndt & Co., Inc.
COMBUSTION ENGINEERING, INC. *
Agency—G. M. Basford Company
CONDENSER SERVICE AND ENGINEERING 124
CONOFLOW CORP. 101
Agency—The Roland G. E. Ullman, Inc.
COPES-VULCAN DIVISION, CONTINENTAL FOUNDRY & MACHINE COMPANY 54
Agency—Davies and McKinney
CRANE CO. 41
Agency—The Buchen Company

DART UNION CO. *
Agency—Sutherland-Abbott
DAVIS ENGINEERING CORPORATION *
Agency—Thomas S. Delehanty, Inc.
DAVIS REGULATOR CO. *
Agency—Armstrong Advertising Agency
DEARBORN CHEMICAL CO. 126
Agency—The Buchen Co.
DE LAVAL SEPARATOR CO., THE 4
Agency—Donahue & Coe, Inc.
DE LAVAL STEAM TURBINE CO. 38
Agency—Michel-Cather, Inc.
DETROIT STOKER COMPANY 43
Agency—Witte & Burden
DOWELL INCORPORATED 25
Agency—MacManus, John & Adams, Inc.
DRY ICE CONVERTER CORP. *
Agency—Wilson Advertising Agency

EASTERN GAS AND FUEL ASSOCIATES *
Agency—Ketchum, MacLeod & Grove, Inc.
EDWARD VALVES, INC. 51
Agency—Marsteller, Gebhardt & Reed, Inc.
ELLIOTT CO. Inside Front Cover
Agency—Peterson & Kempner, Inc.
ELLISON DRAFT GAGE CO. *
Agency—Tri-State Advertising Co., Inc.
ENGINEER CO., THE *
Agency—Michel-Cather, Inc.
ERIE CITY IRON WORKS 10–11
Agency—Davies and McKinney
EVERLASTING VALVE CO. *
Agency—Michel-Cather, Inc.

FARRAND OPTICAL CO. 57
Agency—Firestone Advertising Agency
FOSTER WHEELER CORP. 105
Agency—Rickard & Co., Inc.
FULLER COMPANY 12
Agency—O. S. Tyson and Company, Inc.

GARLOCK PACKING CO., THE *
Agency—Hutchins Advertising Company, Inc.
GENERAL CABLE CORP. 109
Agency—Hicks & Greist, Inc.
GENERAL ELECTRIC COMPANY 115
Agency—G. M. Basford Company
GOLDEN-ANDERSON VALVE SPECIALTY CO. *
Agency—Walker & Downing
GRAVER WATER CONDITIONING CO. *
Agency—Michel-Cather, Inc.
GRINNELL CO., INC. *
Agency—Horton-Noyes Company
GRISCOM-RUSSELL CO., THE *
Agency—Michel-Cather, Inc.
GULF OIL CORP. 39
Agency—Young & Rubicam, Inc.
GUSTIN-BACON MFG. CO. *
Agency—Valentine-Radford

HAGAN CORPORATION 52–53
Agency—Ketchum, MacLeod & Grove, Inc.
HALL LABORATORIES, INC. 31
Agency—Ketchum, MacLeod & Grove, Inc.
HAYS CORPORATION, THE *
Agency—Proebsting, Taylor, Inc.

ILLINOIS WATER TREATMENT CO. *
Agency—Howard H. Monk & Associates
INSTROF, INC. 112
Agency—R. E. Lovekin Corp.
INTERNATIONAL NICKEL COMPANY, INC., THE 103
Agency—Marschalk & Pratt Co.

JOHNS-MANVILLE 117
Agency—J. Walter Thompson Company
JOHNSON-MARCH CORP. *
Agency—Beaumont, Heller & Sperling, Inc.

O. C. KECKLEY COMPANY *
Agency—Armstrong Advertising Agency
KIRK & BLUM MFG. CO. 33
Agency—The S. C. Baer Co.
KOR CORPORATION 126
KULJIAN CORPORATION *
Agency—Roland G. E. Ullman, Inc.

LADISH CO. *
Agency—The Cramer-Krasselt Co.
JAMES LEFFEL & CO., THE *
Agency—Kight Advertising Inc.
LESLIE CO. *
Agency—Macready, Handy & Van Denburgh

MANNING, MAXWELL & MOORE, INC. 20, 99
Agency—Fuller & Smith & Ross, Inc.
METALLIZING ENGINEERING CO. *
Agency—The Schuyler Hopper Co.
MILTON ROY CO. 28
Agency—Harris D. McKinney, Inc.
MINNEAPOLIS-HONEYWELL REG. CO. 36–37
Agency—The Aitkin-Kynett Co.

NATIONAL AIROIL BURNER COMPANY, INC. 102
Agency—R. E. Lovekin Corp.
NATIONAL ALUMINATE CORPORATION 22
Agency—Armstrong Advertising Agency
NATIONAL VALVE & MFG. CO. *
Agency—Bond & Starr, Inc.
NIAGARA BLOWER COMPANY *
Agency—The Moss-Chase Company
NICHOLSON & CO., W. H. 47
Agency—Wilbur A. Myers
NORTON COMPANY *
Agency—James Thomas Chirurg Company

OHIO INJECTOR CO. *
Agency—Fuller & Smith & Ross, Inc.
ORR & SEMBOWER, INC. *
Agency—Beaumont, Heller & Sperling, Inc.

PACIFIC PUMPS, INC. *
Agency—The McCarty Co.
PATTERSON-KELLY CO., INC. *
Agency—O. S. Tyson & Co., Inc.
PEABODY ENGINEERING *
Agency—Richard La Fond Advertising Inc.
PERMUTIT CO., THE *
Agency—Cunningham & Walsh, Inc.
PHOENIX MFG. CO. *
Agency—The Buchen Co.
PITTSBURGH PIPING & EQUIPMENT CO. 111
Agency—W. S. Hill Co.
POWELL VALVES 27
Agency—The Ralph H. Jones Co.
PREFERRED UTILITIES MFG. CORP. *
Agency—Spooner & Kriegel
%PROPORTIONEERS, INC.% *
Agency—Hammond-Goff Co.

RADIO CORPORATION OF AMERICA *
Agency—J. Walter Thompson Co.
RAYBESTOS-MANHATTAN, INC. *
Agency—Gray & Rogers
RELIANCE GAUGE COLUMN COMPANY 104
Agency—Carr Liggett Advertising, Inc.
REPUBLIC FLOW METERS CO. *
Agency—Glenn, Jordon, Stoetzel, Inc.
REVERE COPPER AND BRASS, INC. 45
Agency—St. Georges & Keyes, Inc.
RICHARDSON SCALE CO. *
Agency—O. S. Tyson and Company, Inc.
RIC-WIL CO. 26
Agency—Ritchie & Lattler, Inc.
RILEY STOKER CORPORATION *
Agency—The Davis Press, Inc.
W. S. ROCKWELL CO. *
Agency—Spooner & Kriegel
ROTO DIV. OF ELLIOTT CO. 100
Agency—Jos. S. Vogel & Co.

SCHUTTE & KOERTING *
Agency—Harris D. McKinney, Inc.
SCOVILL MFG. CO. 29
Agency—Edward W. Robotham & Co.
THE SEALUBE CO. 129
Agency—Packard & Kraft, Inc.
SHELL OIL COMPANY 21
Agency—J. Walter Thompson Co.
SIMPLEX VALVE AND METER CO. *
Agency—Cunningham & Walsh, Inc.
SIMS PUMP VALVE CO. 126
Agency—Michel-Cather, Inc.
SINCLAIR REFINING CO. 13
Agency—Morey, Humm & Johnstone, Inc.
SPRINGFIELD BOILER CO. 123
Agency—Armstrong Advertising Agency
STANDARD OIL CO. (INDIANA) *
Agency—McCann Erikson, Inc.
STEPHENS-ADAMSON MFG. CO. *
Agency—Glenn-Jordon-Stoetzel Inc.
STONE & WEBSTER ENGINEERING CORPORATION 56
Agency—Harold Cabot & Co., Inc.
SYNCO CORPORATION *

TAYLOR & CO., W. A. *
Agency—Emery Advertising Corporation
TEXAS CO., THE Back Cover
Agency—Erwin, Wasey & Company, Inc.

U. S. ELECTRICAL MOTORS, INC. 121
Agency—The McCarty Co.
UNITED STATES RUBBER COMPANY 60
Agency—Fletcher D. Richards, Inc.
UNIVERSAL ATLAS CEMENT CO. *
Agency—Batten, Barton, Durstine & Osborn, Inc.

VOGT MACHINE CO., HENRY 107
Agency—Farson, Huff & Northlich

WALLACE & TIERNAN PRODUCTS, INC. 116
Agency—Branstate Associater, Inc.
WATSON-STILLMAN CO. 55
Agency—W. L. Towne Advertising
WESTERN CHEMICAL COMPANY 106
Agency—Carter Advertising Agency, Inc.
WESTERN PRECIPITATION CORP. 61
Agency—Dozier, Eastman & Co.
WICKES BOILER CO., THE 18–19
Agency—Price, Tanner & Willox, Inc.
WILSON, INC., THOMAS C. 121
Agency—Michel-Cather, Inc.
WING MFG. CO., L. J. 110
Agency—Willard G. Myers Advertising Agency
WORTHINGTON CORPORATION *
Agency—James Thomas Chirurg Company
WRIGHT CHEMICAL CO. *
Agency—Schnell & Associates

YARNALL-WARING COMPANY 8–9, 62
Agency—The Michener Co.

*Firms whose advertising is not in this issue but is appearing in other issues is marked with an *

"cold galvanize" with a paintbrush!

ZRC (Zinc-rich Coating) rust-proofs iron and steel for years. Easy to apply — paint on or spray on — ZRC costs less than 1½¢ per sq. ft. of 100% corrosion protection.

For complete information, write Dept. P.

The SEALUBE COMPANY
Wakefield, Mass.

REPRESENTATIVES — SOME TERRITORIES OPEN

For more data circle 588 on Post Card

Control Overhead Valves Easily

WITH . . . **Babbitt** *Adjustable* SPROCKET RIM *with Chain Guide*

Operate any out-of-reach overhead valve with ease — right from the floor! Babbitt Adjustable Sprocket Rim with Chain Guide makes any valve instantly accessible — simplifies overhead pipe layouts, prevents steam waste, provides low-cost accident prevention, too. Easily installed, ready for operation in a few minutes.

- **Saves money on fuel & steam**
- **Does away with accidents**
- **Positive, efficient valve control**

Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple, quickly-assembled parts.

Call your Industrial Distributor. He carries complete stocks. Or write for descriptive folder and prices.

Babbitt STEAM SPECIALTY CO.
4 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS

For more data circle 587 on Post Card

Here's why
BLAW-KNOX COAL BUCKETS ARE PREFERRED
by the most experienced
POWER PLANT OPERATORS

● Outstanding performance and dependability resulting from many years of Blaw-Knox design experience are only two of the many reasons why the leading Power Plants continue to place repeat orders for Blaw-Knox Coal Buckets.

Blaw-Knox Company is the foremost expert in designing clamshell buckets for handling coal or coke.

Experienced Blaw-Knox engineers will gladly discuss your coal or coke handling problems and recommend the correct bucket size and weight for your needs without obligation.

Ask for Bulletin 2433.

BLAW-KNOX CLAMSHELL BUCKETS
FOR COAL OR COKE

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
Dept. 471
PITTSBURGH 38, PA.
Offices in Principal Cities

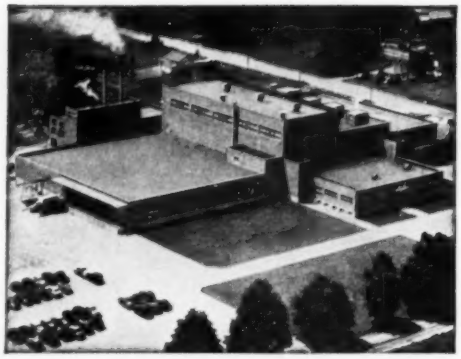
THE MOST COMPLETE RANGE OF SIZES AND WEIGHTS

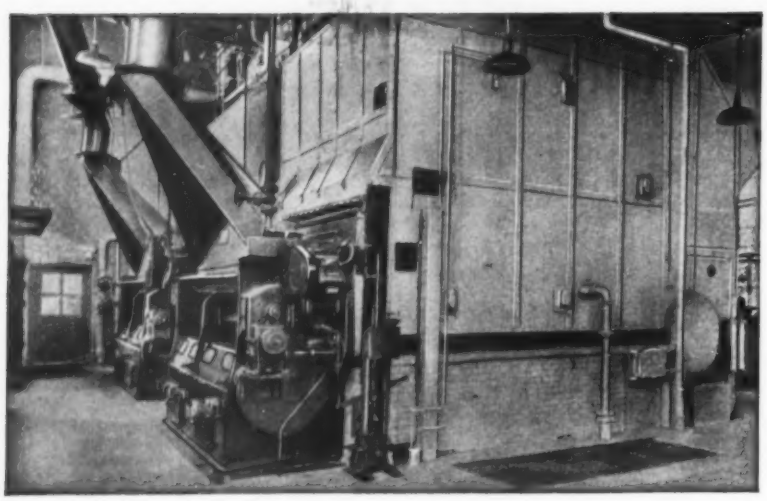
For more data circle 589 on Post Card

"COAL'S BEST FOR OUR MODERN PLANT!

It's low in cost . . . It's clean and convenient!"

says G. W. Peters, Engineering Manager
M&R DIETETIC LABORATORIES, INC.
makers of PREAM & SIMILAC





"We made a careful study of fuels and burning equipment before building our modern new plant in Sturgis, Michigan. This plant was designed to produce baby food. So the steam plant has to be clean and dust-free as well as economical to operate. Also, we wanted a fuel we could store safely and easily in order to insure ourselves against any shortages.

"We decided on bituminous coal—and the up-to-date installation shown here. It certainly fills the bill on every count. Our modern combustion equipment makes coal far more economical than any other fuel. Up-to-date coal and ash handling give us convenient operation completely free of dust nuisance."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

Discover for yourself the great advantages of coal burned the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust-free.

If you plan to remodel or build a new plant, be sure to look into the low cost and convenience of bituminous coal. Consider coal's other advantages, too. It has reserves that are virtually inexhaustible. America's bituminous coal mining industry is the most efficient and productive in the world. With bituminous coal, you can be sure of plenty of fuel at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

For more data circle 590 on Post Card

Special Qualities at Standard Prices

...in CHAPMAN Steel Valves

When you buy Chapman Steel Valves, you buy dependable operation and low maintenance cost — you can select steels to meet your specifications from over a dozen alloys made in Chapman's own steel foundry, under rigid scientific supervision.

When your valves are Chapman, you're sure they seat tightly and accurately, without jamming, chattering or wearing excessively. Close tolerances mean long service and little maintenance.

The Chapman Steel Valve line, — gates, globes, and checks, is complete for pressures of 150, 300, 400, 600, 900, 1500 and 2500 pounds and temperatures to 1000°F; all types of gates and globes excepting the 150 lb. class are available with 3 types of bonnet joints — welded, pressure seal, or bolted. Each has its own particular application depending on the medium to be handled.

Chapman's long experience and mass production mean economies. Quality is unsurpassed. So it pays to see Chapman first for every steel valve requirement . . . standard or special, gate, globe, angle or check. Chapman Steel Valves equal or exceed A.S.A. standards in every range. Write now for Catalog No. 20.

The CHAPMAN Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

For more data circle 591 on Post Card

MORE THAN 10 TIMES AS OXIDATION-RESISTANT

TESTS PROVE that *Texaco Regal Oil R&O has more than ten times the oxidation-resistance* of ordinary turbine oils. That's why, in actual turbine service, it has far superior ability to prevent sludge, rust and foam.

Texaco Regal Oil R&O also offers you an extra long service life. You can count on it to keep turbine systems clean, bearing temperatures normal, governor response instantaneous.

There is a complete line of *Texaco Regal Oils R&O* to assure these benefits whatever the size or type of the turbines. *Texaco Regal Oils R&O* meet the most stringent requirements of all leading turbine builders.

A Texaco Lubrication Engineer will gladly help you make the proper selection for your turbines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write the Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

REG'D M

TEXACO Regal Oils R&O

FOR ALL TURBINES

For more data circle 592 on Post Card